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AUGUST 12, 1985

CAN JERRY JUNKINS GET TI BACK ON TRACK?

PAGE 22

SURFACE MOUNTING SPARKS INNOVATION IN PASSIVES/40

CONNECTING FAST ICs SO THEY CAN DO THEIR STUFF/46

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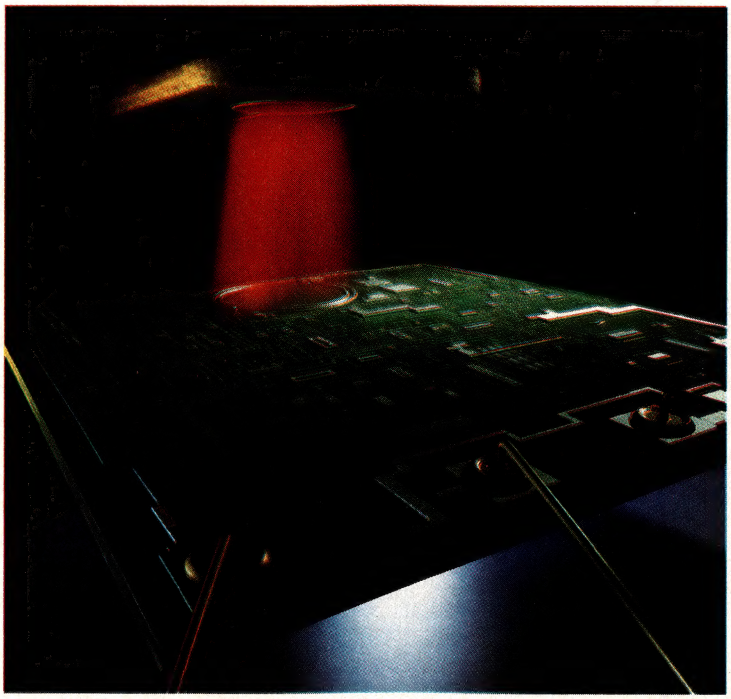

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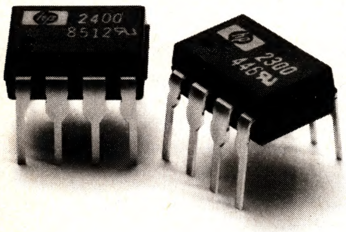

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AUGUST 12, 1985 VOLUME 58, NO. 32

Electronics

PROBING THE NEWS

COVER: Can Jerry Junkins get TI back on track? 22
A companywide bout of soul-searching is under way at Texas Instruments, where Jerry R. Junkins was named to head the company after the abrupt departure of predecessor J. Fred Bucy in late May. Junkins and his management team face an Augean task: the $5.7 billion company's growth strategy has been derailed by the steep 1984-85 market recession. Junkins is starting out cautiously, but he apparently plans to drive ahead in advanced integrated circuits and to rally TI's eight main businesses around its expertise in artificial intelligence.

After 12 weeks on the job, Junkins has already made one thing clear. He is convinced that technology alone can't get the company back on the rails. "It is more important than ever that technology and cost leadership be supplemented with some very strong customer relationships," he says.
Cover photo: Ben Weaver

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Passive components are following the rising tide of surface-mounted active devices, as the new space-saving, rugged packages are being adopted for the entire range of passives. Other changes are evolving from technological innovations such as new materials and from marketing considerations

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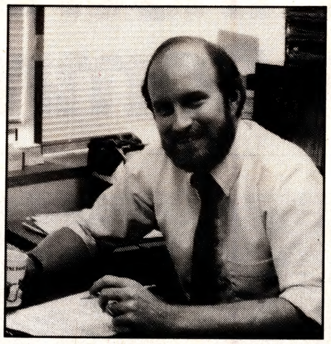
EYES OF TEXAS. Rob Lineback keeps a close watch on TI.

Around the sprawling headquarters of Texas Instruments Inc., one of the more familiar faces is that of our man in Texas, Rob Lineback. TI obviously is a key company on the Dallas bureau manager's beat, and it's a rare week that he doesn't talk to someone there who counts.

His face became even more familiar around TI in late July as Rob interviewed key company executives to garner information for this week's cover story, an in-depth profile on TI beginning on p. 22.

Rob's piece tells the story of a $5-billion-plus company whose record year in 1984 came amid three losing quarters (although it still remains the world's leading chip supplier). It now has to realign itself with the emerging growth markets of the late 1980s under the leadership of new president Jerry R. Junkins.

Lineback, who is a native of Dallas, has already seen substantial change at the company since he started tracking it for us in 1980. "Back in the 1950s, Texas Instruments was very much a Texas company, new to commercial electronics but willing to take risks, with its roots in seismic oil-search running deeply throughout its management and work force," he says. "Today, TI is perhaps the most international electronics manufacturer in the world. With three plants in Japan, it has the strongest presence there of any Western semiconductor house.

"But since 1980, the company has been attempting to move away from a conservative approach to volume businesses. It seems more willing to take risks in new markets for integrated circuits, computers, and government electronics. In a way, old-timers at TI see it as a return to some of the free-wheeling spirit that took it into the solid-state revolution, and eventually, a leadership position in shipments of ICs."

Another of our staff members who confronted change while doing a piece for this issue was Jerry Lyman, our packaging and production editor. Visiting Rogers Corp. for a Technology to Watch feature about the company's interconnection systems for high-speed ICs (p. 46), Jerry found it hard to believe he was at the same company he saw a decade ago for an article on die-punched printed-circuit boards. "They used to be mainly a materials company, supplying elastomeric shoe-cushioning, among other things," he recalls.

Rogers' engineers now work with sophisticated computer-aided-design tools as they carry on 13 research and development programs involving high-speed interconnections. But, notes Jerry, "they still make a few punched pc boards and a lot of shoe-cushioning material."

Laurence Altman

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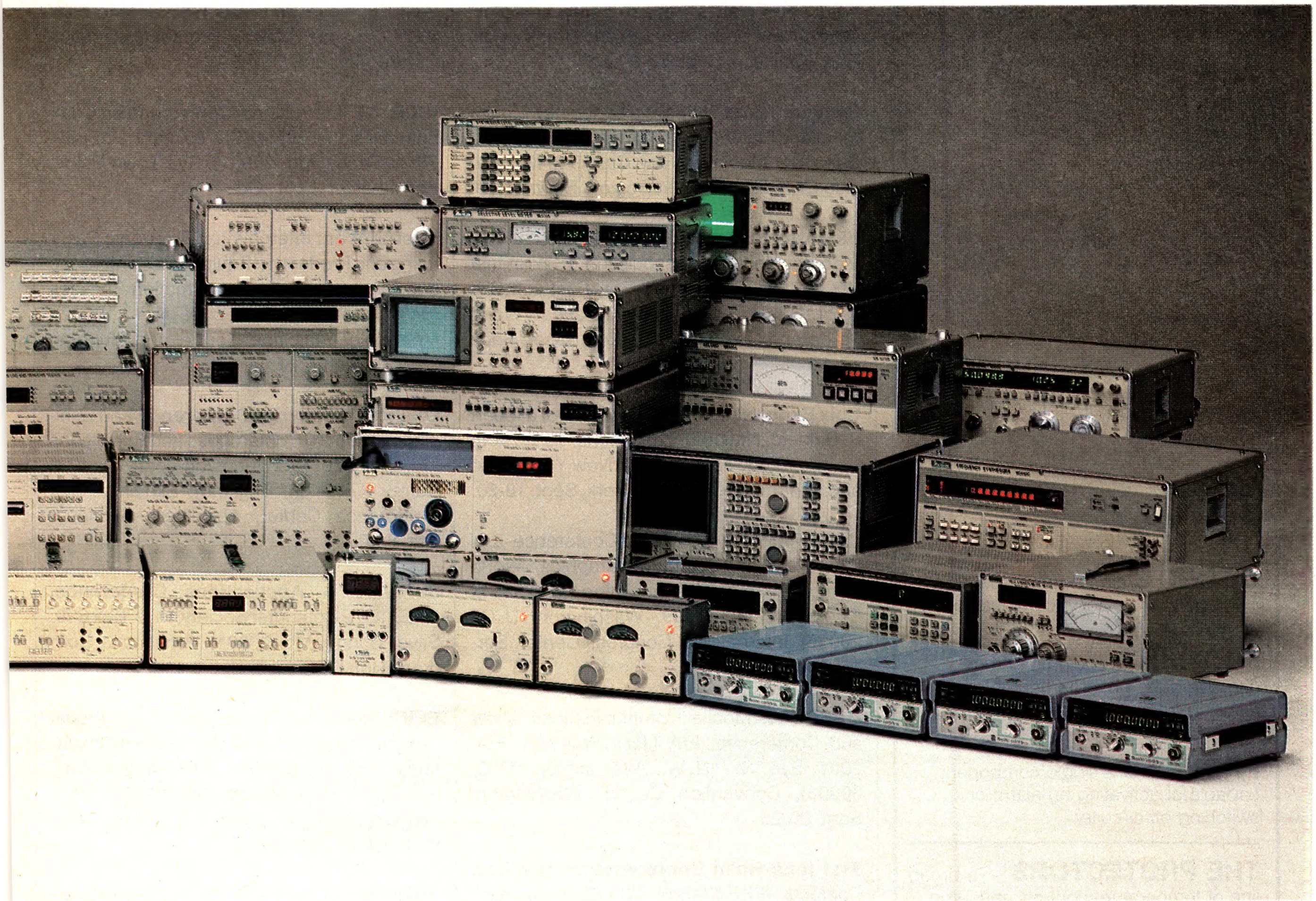

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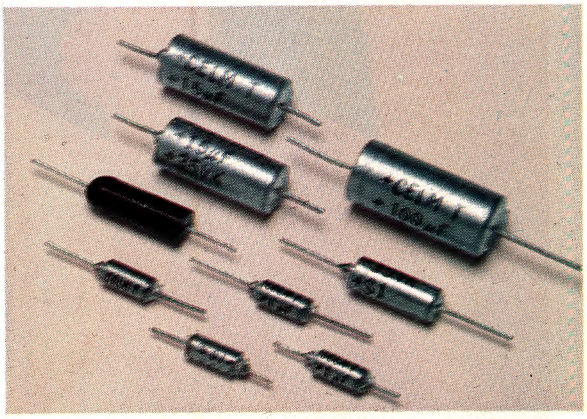

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THIS Electronics WEEK

THURSDAY *August 1*

Lotus Development Corp. said it has created three new divisions: Business Products, International, and Information Services. The last of the three was created to manage and expand the offerings of Dataspeed Inc., which the Cambridge, Mass., software maker acquired at the end of April [*ElectronicsWeek*, May 6, 1985, p. 17]. Lotus also introduced a $75 upgrade for current registered users of its Symphony 1.0 program. The enhancements include increased memory and speed as well as expanded file-translation capabilities with Lotus's other products, 1-2-3 and Jazz.

FRIDAY *August 2*

Philip ("Don") Estridge was one of six IBM employees killed when a Delta Air Lines jet crashed in Dallas today. Estridge, who headed the development team for IBM's highly successful Personal Computer from 1980 through its August 1981 introduction, was credited with developing the PC's high-volume manufacturing process and with steering the company toward such innovations as reliance on third-party component manufacturers, software developers, and distributors. He left the personal computer division in March to become vice president of world-wide manufacuturing for IBM. . . . Citing continuing slow sales and stiff competition from Japan, **National Semiconductor Corp. said it will shut down operations in both U. S. and European offices for at least five days this quarter.** National will continue shutdowns each quarter until conditions improve and that it will defer all wage increases for an indefinite period. Company president Charles Sporck said he does not expect any significant upturn during this calendar year, despite some analysts' claims to the contrary [*Electronics*, Aug. 5, 1985, p. 15].

MONDAY *August 5*

Intel Corp. announced the **first customer shipments of its iPSC family of concurrent computers.** The iPSC architecture is based on the hypercube interconnect structure, developed under federal funding at the California Institute of Technology [*ElectronicsWeek*, Feb. 11, 1985, p. 11]. Each system is made up of multiple computational nodes, each with its own memory and each independent of the other. The nodes are connected by dedicated communications channels. Intel said the first two recipients—Yale University's Research Center for Scientific Computation in New Haven, Conn., and the Oak Ridge National Laboratories in Oak Ridge, Tenn.—will use the system to study applications and algorithms in concurrent processing.

TUESDAY *August 6*

Digital Equipment Corp. said net income for the fiscal year ended June 29 increased 35% over a year ago, to $446.7 million. The gain came despite a fourth quarter in which earnings fell 24%, to $100.4 million from $130.6 million, from the same period a year ago. The Maynard, Mass., company, which said it ended the year with more than $1 billion in cash reserves, credited strong sales abroad, offsetting the weakness in the U. S.

WEDNESDAY *August 7*

Microcomputer Memories Inc. said it is expanding its Van Nuys, Calif., plant by 45,000 square feet in order to bring its 20-megabyte disk drive into high-volume production. The maker of 3½-in. Winchester disk drives for original-equipment manufacturers said it expects the expansion to be completed by November. □

ELECTRONICS NEWSLETTER

COOPERATIVE PROGRAM TARGETS OPTOELECTRONICS MANUFACTURING

Moving optoelectronic devices out of the laboratory and into mass production is the aim of a Battelle Memorial Institute project that is looking for corporate sponsors. So far, nine U. S. companies (including one foreign subsidiary) have agreed to support the 42-month, $12 million cooperative research project on manufacturing technologies, organized by Battelle's Columbus, Ohio, division. The project's structure is similar to that of the Microelectronics and Computer Technology Corp., a two-year-old cooperative program in Austin, Texas [*ElectronicsWeek,* Oct. 15, 1984, p. 8]. Battelle has set an Aug. 15 deadline for charter membership; the effort is slated to start Aug. 19. For a $600,000 base subscription fee, charter members can exchange proprietary technology information from the first day, and get a royalty-free license to key inventions. There are strict criteria to prevent transfer of technology outside the U. S. The nine companies that have signed letters of intent are 3M, Advanced Semiconductor Materials America (a wholly owned subsidiary of Advanced Semiconductor Materials International NV, the Netherlands), Allied, Amp, ITT, Litton Systems, Motorola, RCA, and Thomas & Betts. ☐

FRANCE AND SPAIN BAIL OUT, BUT EUROPEAN FIGHTER PROJECT GOES ON

France and Spain have withdrawn from negotiations for a five-nation European air-to-air fighter for the 1990s, but Britain, Italy, and West Germany will press ahead with the project. The joint venture will ultimately lead to production of more than 650 aircraft at a cost of more than $13.5 billion, some 40% of it to go for avionics.

For their next-generation fighter, the three nations plan a control-configurable vehicle having a double-delta wing with canard stabilizing surfaces. The configuration makes for a highly maneuverable aircraft, but one that is too unstable aerodynamically for a pilot to fly on his own. Hence the plane will have digital electronic actuation for its flight-control surfaces, a technology already demonstrated in-flight by a British Aerospace Jaguar aircraft fitted with such a system. British Aerospace has already embarked on the design of an Experimental Aircraft Program demonstrator embodying most of this technology. It is scheduled to go aloft in the second quarter of 1986. ☐

JAPANESE DRAM MAKERS HAVE U. S. PRODUCERS 'ON THE ROPES,' SAYS ICE

Japanese makers of 256-K dynamic random-access memories continue to pick up the pace while U. S. producers lag behind in high-density chip production, according to market researcher Integrated Circuit Engineering Corp., Scottsdale, Ariz. "We think the Japanese producers have a lot of U. S. producers on the ropes, and the 1-Mb chip may be the knockout punch," says William McClean, senior analyst, who will present findings at ICE's Mid-Term Status '85 seminar, starting next week in Sunnyvale, Calif. Five Japanese DRAM vendors are now firmly at the top of ICE's 256-K leader list; the U. S. leader is Texas Instruments Inc. (see related story, p. 22). ☐

EUROPEAN MINISTERS TO MEET AGAIN ON EUREKA

European ministers of research and technology plan to hold a second meeting on Eureka Nov. 5 and 6 to discuss the program's financial and administrative structure. Eureka is the European research and development program proposed by the French government as an alternative to participation in the U. S.'s Strategic Defense Initiative. Participants The 16 countries involved agreed on generalities at their first conclave in Paris last month [*Electronics,* July 22, 1985, p. 30]. At the second meeting, in Hanover, West Germany, they will attempt to define more clearly the program's projects. ☐

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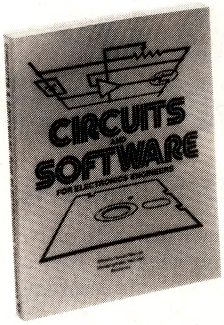

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Responsibilities include component selection; parts development; applications support and interface with designers, manufacturing, MRB and vendors; and spec preparation and maintenance. Perform failure analysis and make presentations to management. Positions available for various levels of experience with a minimum of 2 years in design/development engineering plus 2 years in component engineering. Experience with MIL-M-38510, MIL-STD-883, MIL-M-19500 and MIL-STD-750 required. Experience associated with radiation hardness of semiconductors desired. BSEE preferred.

Passive Component Engineer

Responsibilities similar to those stated in the preceding position description. Experience however should be in the general passive component area with specific openings in **magnetics** (MIL-T-27 and MIL-STD-202) and **connectors** (MIL-C-38999, 83513 and 23353).

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To deal with total-dose radiation, reflected in a threshold shift in a MOS FET, gate oxides can be kept thin during fabrication, Dawes notes. For the Siliconix device, the test criterion was a shift of less than 1 V; a larger shift was defined as a device failure.

Cooper emphasizes that Siliconix does not yet have a product family employing the new technology, which he says is proprietary. The firm "will patent some of the novel structures," he says and adds that they could find applications on the commercial side as well.

No other MOS FET maker is known to be pursuing radiation-hardened devices of the Siliconix type. "It's a prestige item, but the market is still small," says one company official. Demand for radiation-hardened MOS FETs represents about 15% of sales to military customers, who buy some 25% of all MOS FETs. Dataquest Inc., San Jose, Calif., estimates the total U. S. market for power MOS FETs to be nearly $180 million for 1985. The market has been a healthy one for Siliconix, which is doing well. All the same, Westinghouse Electric Corp. is selling its third of the company's stock (see "Westinghouse puts 34% of Siliconix on block," above).

Siliconix has taken more of an interest in radiation hardening than its commercial MOS FET rivals, industry sources agree. This program has been under way for several years, according to Cooper. *–Larry Waller*

WESTINGHOUSE PUTS 34% OF SILICONIX ON BLOCK

Chip maker Siliconix Inc. has sailed through the steep semiconductor slide without the troubles afflicting most of its peers, mainly because it had little involvement with the computer market. But early this month, the Santa Clara, Calif., company got an unexpected jolt: Westinghouse Electric Corp., Pittsburgh, suddenly announced it intends to sell the 34% stake in Siliconix it has held since 1981.

Siliconix had little warning of the plan and is not being consulted about possible buyers, according to sources. Neither company is talking about reasons for the proposed sale, but it is common knowledge among informed industry officials that the two managements have not gotten along well. Westinghouse holds two of Siliconix's six director posts. There is no timetable for the sale nor are any hot prospects waiting in the wings, a Westinghouse representative says.

Whatever the outcome, the business outlook for Siliconix remains bright. After reporting a 25% jump in sales, to $51 million, and a solid profit gain for the first half of 1985, the company expects further improvements. –L. W.

MILITARY

COMPUTER CONTROLS COPTER'S AVIONICS

OWEGO, N.Y.

The U. S. Air Force and IBM Corp. are on the brink of a bold new step in helicopter avionics with a prototype of a production-model helicopter incorporating what they call a fully integrated cockpit. A computer controls the entire avionics package—including navigation, communications, defense systems, and engine and air-vehicle avionics. The same computer also manages much of the display of flight data and helps the crew fly the chopper.

Use of the computer not only reduces the information burden on the pilot and copilot, but eliminates the need for a flight engineer, saving money as well as space in the helicopter. It also simplifies controls: the crew enters commands using software-configurable keys that surround two cathode-ray tubes.

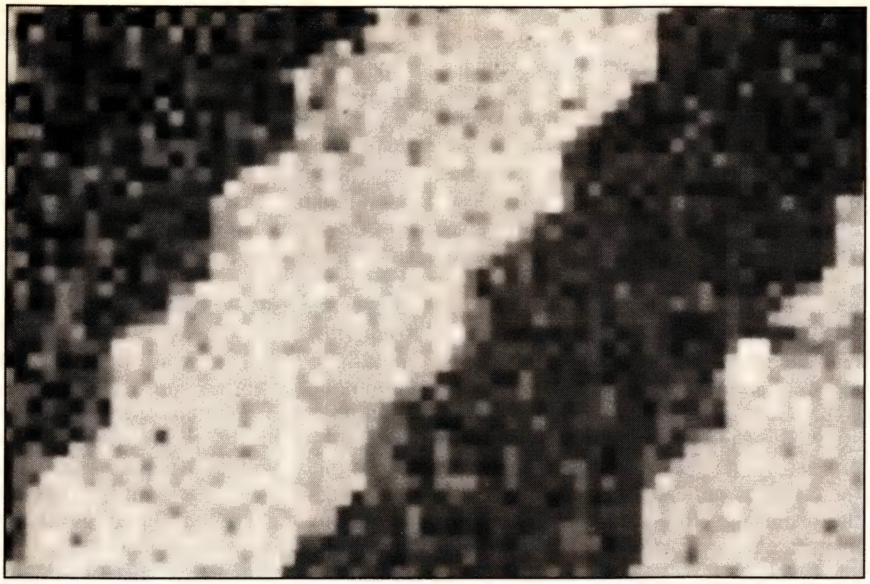
"This is the forerunner of what helicopters will be in the future," says Cecil Richardson, manager of avionics systems engineering for IBM. "All the smarts are in the system's computer. It's software-controllable and very powerful." He expects more choppers with similar systems to appear because "our cockpit is a generic-type cockpit, software controlled, which can be configured to handle any sort of mission."

The USAF and IBM took the wraps off the HH-60A Night Hawk at IBM Federal Systems Division's sprawling facility in Owego, N.Y. The Night Hawk, derived from the UA-62 Black Hawk, was enhanced to meet the rigorous demands of search-and-rescue missions. An important part of these enhancements is the Night Hawk's use of sophisticated electronic components that puts the aircraft on the cutting edge of technology.

IBM acted as a systems integrator, taking 179 hardware components—58 of which came from government inventories—from 17 subcontractors for the Night Hawk's avionics and cockpit. Then the computer company worked up a program consisting of 96,000 words in a high-level language to run the system.

The new avionics package is built

SEARCH BY NIGHT. The U. S. Air Force's Night Hawk helicopter is set up for long-range nighttime search-and-rescue tasks. Its sophisticated computer-integrated avionics help combat pilot fatigue on long missions.



FLUX LINES. The NBS system images areas of opposite magnetization as light and dark.

polycrystalline gold film to measure the spin polarization of incoming electrons.

Typically, a magnetic material contains regions or domains in which electron spins are oriented in a preferred direction. The preferred direction may vary from one domain to another. For the first time, Ungeris notes, researchers can now look at high-resolution images showing clearly the borders between such domains to determine how one domain differs from another and, hence, how they develop.

Ungeris says his group is working to resolve problems with the first microscopic photographs obtained last December. Meanwhile, he says, IBM Corp.'s San Jose research laboratory and Honeywell Inc. have expressed interest in the instrument. *–George Leopold*

PACKAGING

HYBRID TECHNOLOGY UPS INTERCONNECT DENSITIES

BRAINE LE CHATEAU, BELGIUM

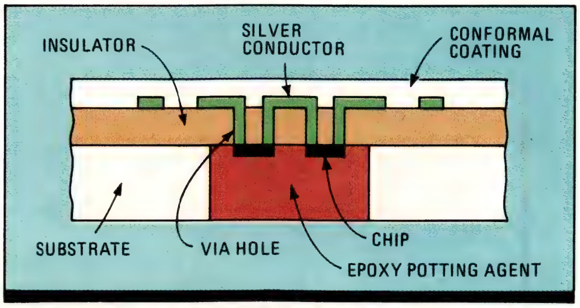
A new high-density hybrid integrated-circuit technology may be the answer to a question posed by the increasing complexity of ICs: how can a multiplicity of inputs and outputs be interconnected within a system without adding more cost than value?

Developed at the laboratories of PA Technology SA in this Brussels suburb, the process uses inexpensive materials and standard photolithographic processes, while offering interconnection densities comparable to state-of-the-art technologies. It also features significant new production advantages.

Code-named Octopus, the technique was developed with financial support from Prutec, the venture capital arm of the Prudential Insurance Co. of America, Newark, N. J.

PRODUCTION BASICS. Based on ultraviolet-cured materials, the process could prove to be cheaper than any other currently known. It works at room temperature; other hybrid technologies require much higher temperatures. Further, each layer's production process takes only a few seconds to realize: 0.5 s for the conductive layer, 0.1 s for the dielectric, and a few seconds for washing off the exposed material. It is repeated for each interconnection layer a circuit requires.

Octopus can produce circuits in two basic configurations. In one, chips are mounted in cavities in the substrate; in the other, chips are bonded to a conductive layer on the substrate through levels of dielectric. Boards produced either way will operate in a temperature range of –25°C to +125°C.



UPS AND DOWNS. PA Technology's Octopus realizes interconnections as dense as tape-automated bonding, for less.

Both configurations begin with a planar substrate. PA Technology produced its first samples using Octopus with glass substrates, but has since moved on to aluminum and aluminum alloys to take advantage of their superior thermal characteristics.

For the first configuration, holes for mounting chips are drilled in the substrate. After the chips are inserted, the holes are filled with an epoxy potting agent to form a continuous planar surface on the bottom of the substrate.

CONDUCTIVE LAYER. Next, the substrate is flipped over and the insulator—in the form of a UV-curable polymer dielectric layer—is laid down. This layer is exposed though a mask and developed to leave via holes, or windows, that lead to the pads of the chips underneath. Then UV-curable silver flake covers the dielectric, filling the via holes, to create a conductive layer in which interconnections are patterned.

When the silver conductive layer has cured, the process is repeated until the circuit is complete. A conformal coating covers the entire circuit board.

With this configuration, PA Technology has fabricated circuits with up to four interconnection layers. Keith Browne, PA Technology's manager for interconnection technologies, does not yet know how many layers this technology will support. The fact that each deposit of dielectric makes the surface planar bodes well for a high number of layers.

The second version does away with cutting holes in the substrate and inserting chips into them. Instead, the substrate is first covered with the dielectric layer and interconnections are built up on the substrate. A final deposition of dielectric is made, with windows to allow the chip to make contact with the final conductive layer through the final dielectric layer. Bumped chips are then mounted on the surface.

Because in the first configuration any mounted chips are lost—as they are encapsulated in epoxy—if the final circuit doesn't pass muster, it is likely to be used for inexpensive applications. One advantage is that if properly coated, the substrate with inserted chips and mounted circuitry could be embedded in the housing of a product such as a calculator. Systems with large numbers of expensive components would require the second configuration, where interconnection circuitry could be tested before the chips are mounted.

Browne believes Octopus compares favorably with other current techclaims to be the first to bring such a product to market.

Thomson considers mask-programmable filters strategically important. Zenyk Horbowy, director of ASIC products in the company's MOS Division, notes that filters are penetrating virtually all sectors of electronic equipment. As this creates a need for ever more types of filters in varying quantities, the company is taking the semicustom approach to deal with this situation.

Most of the area of its mask-programmable filter chip, the EFG 85XX, is devoted to eight elementary cells. Each cell consists of a switched capacitor and two separate capacitor areas. The high-density-CMOS switched capacitors are interconnectable. Each capacitor area contains a large number of incremental capacitors with a value of 0.1 pF each.

The switched capacitors can be interconnected according to the type and order of filter required. Incremental capacitors would be interconnected in a way that meets the gain and frequency-response requirements of the application.

The plan is to lure ASIC customers it might otherwise miss

Using this technique, Thomson can produce any type of filter (Cauer, Butterworth, Chebyshev, and so on), for any general application, including low-pass, high-pass, band-pass, notch, or group-delay time corrector. Unlike standard gate arrays, Thomson's mask-programmable filters need no customer design, even for the final mask, whose corresponding aluminum layer determines the filter's characteristics. Customers need only specify the filter parameters, and Thomson generates the mask using its own computer-aided design system.

The sampling frequency of the filters is between 500 Hz and 1 MHz, with the cutoff frequency between 10 and 200 times that figure, depending on the kind of filter being realized.

Thomson claims it can turn specifications into silicon in no more than eight weeks. In addition to semicustom circuits, the company will market a line of 10 standard filters based on the array. *–Robert T. Gallagher*

CONSUMER

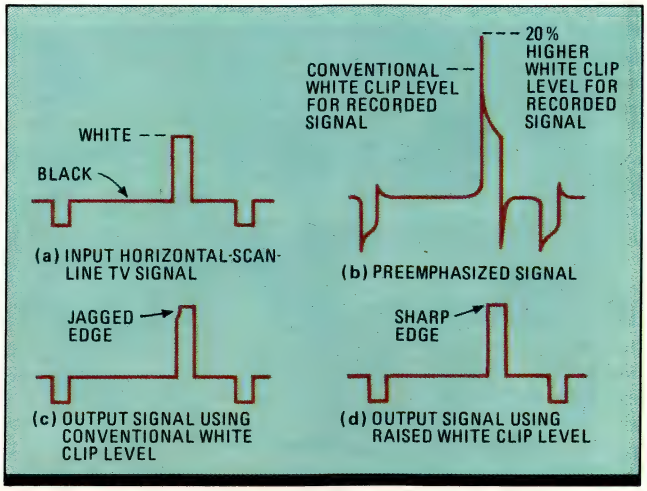
JVC SHARPENS PICTURE IN VCR WAR

TOKYO

Victor Company of Japan is escalating its assault on Beta-format pioneer Sony Corp. in the ½-in. and 8-mm videocassette-recorder arenas. Counterattacking the "Hi-Band" Beta VCRs that Sony went to market with in January, Victor on August 31 will launch the first of a series of "High-Quality" VCRs that it claims outperform Sony's in picture sharpness and signal-to-noise ratio. The upgraded machines, Victor maintains, are compatible with current VCRs.

With this move, Victor—the originator of the Video Home System—has two aims. For one thing, it wants to keep up the momentum that has seen VHS VCRs capture more than 80% of the ½-in. market and win converts among all Beta manufacturers except Sony, despite Sony's claim that its models have higher resolution. For another, Victor wants to maintain a large performance gap between ½-in. VCRs and 8-mm units—which it doesn't make—in order to extend the life of the VHS system as the mainstay of the market. In this respect, its goals differ greatly from Sony's. Most observers believe Sony is trying arrange an orderly switch to 8-mm without appearing to abandon the Beta system with which it created the consumer VCR market.

Victor's approach to higher sharpness is based on a white-peak-level clipping technique that works within the original frequency scheme in order to ensure high compatibility with existing VCRs. The pre-emphasized signal is clipped at a white-peak level 20% higher than first-generation recording to provide recorded images with sharper edges, a method that all VHS manufacturers have been using since this spring.


WHITE
BLACK
(a) INPUT HORIZONTAL-SCAN-LINE TV SIGNAL
CONVENTIONAL WHITE CLIP LEVEL FOR RECORDED SIGNAL
20% HIGHER WHITE CLIP LEVEL FOR RECORDED SIGNAL
(b) PREEMPHASIZED SIGNAL
JAGGED EDGE
(c) OUTPUT SIGNAL USING CONVENTIONAL WHITE CLIP LEVEL
SHARP EDGE
(d) OUTPUT SIGNAL USING RAISED WHITE CLIP LEVEL

WHITE NOISE. By raising the white clip level of the recorded signal 20%, Victor's new technology can put out a sharper-edged signal.

RECURSIVE COMB FILTERS. The High-Quality models take advantage of the clipping by means of recursive comb filters in both the luminance and chroma channels. The filters are designed for compatibility with tapes recorded on earlier VCRs as well as with those recorded on the High-Quality systems. They reduce noise—both edge noise and broad-area noise—and enhance the edges between light and dark areas in the image.

"The recursive comb filter for the luminance channel is built around a charge-coupled-device delay line, while that for the chrominance channel is built around a glass delay line," says Mitsuo Fujita, general manager of the Development Department in the Video Products Division.

Clocking provides a precise delay in the CCD, which inherently has the high bandwidth needed for luminance-signal processing. Nonlinear compensation, which prevents degradation of vertical resolution, is required because successive lines in the TV picture do not always correlate.

Victor's introduction of its High-Quality products appears to be a reprise of an earlier battle that started in mid-1983, when Sony added high-fidelity frequency-modulated audio recording to the picture channels of Beta VCRs. Sony's move to better audio recording resulted in resolution problems, which shifted the battle between Beta and VHS to a new arena. Until then, Sony fought on the grounds that it had the better image.

Sony's temporary advantage was nullified when VHS manufacturers developed a method of FM recording using separate heads for video and audio recording [*Electronics*, June 16, 1983, p. 82]. This apparently similar scheme is much neater. The audio signals are recorded deeper in the tape magnetic coating than the video signals by heads with wider gaps and a different azimuth angle than the video heads. Differences in recording depth, head gap, and azimuth angle provide sufficient separation of video and audio signals even though frequencies overlap between the make it possible to integrate complete filter sections on chip, given on-chip capacitors of sufficient capacity.

Until recently, chip makers built capacitors on bipolar ICs by using a reverse-biased diode structure. Frequency performance was nonlinear and temperature coefficients were poor with such devices. But today, high-value capacitors of good performance can be made using a parallel-plate structure and a thin dielectric layer of silicon nitride. The Philips bipolar process delivers devices with a specific capacitance of 1.5 nF/mm^2.

Gyrator circuit simulates on-chip inductor for filters

Using these new devices, Moore and his team have packed the two audio-frequency filters that a direct-conversion receiver needs onto only 3.7 mm^2 of silicon. Current consumption is less than 30 μA at 1.11 V, and the filters are programmed by a single external resistor. Philips also uses gyrator techniques to introduce a quadrature phase change in one of the two receiver channels.

Developing the ability to integrate large filter sections on chip justifies the program, says Moore. Such filters have countless applications. An advantage of gyrator-based filters over the more common switched-capacitor devices is that the gyrator filter operates in continuous, as opposed to sampled, time and so does not need antialiasing filters. He says the technology has now been demonstrated up to 40 MHz. *–Kevin Smith*

PEN-SIZE PAGER SPORTS BUILT-IN 12-DIGIT DISPLAY

BOYNTON BEACH, FLA.

Plying its skills in the design of miniaturized displays and in software, Motorola Inc. is taking aim at the fastest-growing segment of the $390 million U.S. radio-pager market—units with built-in displays—with a new version of its fountain-pen-size Sensar pager. The new unit features a 12-digit numeric liquid-crystal display with characters 0.11 in. high.

At 5.4 by 0.91 by 0.42 in., the numeric-display version of the Sensar is the smallest pager of its type on the market. With shipments beginning in late June, it adds another model to what is already a broad line of pagers offered by Motorola. The firm is the dominant pager manufacturer, with a U.S. market share estimated at more than 75%.

The numeric display eliminates the need for the user to call his office to get the number he is to call, as is necessary with tone-only "beeper" models. Both alphanumeric display pagers and tone-and-voice pagers—the other two major pager types—can provide the same kind of convenience. But prices for alphanumeric pagers remain relatively high, compared with numeric-display units. And tone-and-voice units, which provide an audible message to the user, have been hindered by system constraints that limit the number of units a single radio channel can serve.

Motorola engineers managed to graft the 12-digit display onto the Sensar body with very little added bulk. The display adds a segment that protrudes only 0.150 in. from the Sensar body. Housed in that segment is a sandwich consisting of the LCD, a light diffuser, and a tiny printed-circuit board that carries two custom CMOS display-driver chips.

Although surface-mounted packaging suffices in the rest of the Sensar design, Motorola engineers decided to miniaturize by attaching the driver chips directly to the pc board. Attached with an epoxy, the chips are wire bonded and covered with a proprietary coating, says Sensar product manager Merle Gilmore.

PHONE HOME. Packaging and software know-how let Motorola graft a display on its tiny Sensar pager.

Gilmore also credits Motorola software engineers with developing a compact coding scheme that makes possible numerous features, including several not found on competitive pagers. Though the industry norm is a capacity for four 20- or 24-digit numeric messages, for example, the Sensar's 12-digit display can show five 24-digit numbers. What's more, the Sensar is offered with an optional "mail drop" that can keep track of up to four messages (such as stock quotes, for example) by assigning each its own address in memory. The user can check these at his leisure, because the mail-drop message is renewed periodically and silently.

Other software features include duplicate-message detection, so that memory slots are not taken up unnecessarily, and an ability to protect three slots from being overwritten by incoming messages. A CMOS version of Motorola's 6805 microcomputer carries the software in 4-K bytes of read-only memory.

Motorola's Pager Division in Boynton Beach, Fla., has demonstrated that it is possible to build a small and elongated pager like Sensar with high structural rigidity and long-term reliability. The tone-only version has performed well in the field, says Gilmore. "We're seeing a failure rate of below 1% per month for all of our pagers, and the tone-only Sensar is significantly below the average."

LIGHT BUT TOUGH. The new numeric-display Sensar weighs in at a mere 1.75 oz, including battery, and is built with the same polycarbonate plastic housing used in other Motorola pagers. Gilmore says the packaging provides a good tradeoff in terms of impact strength versus brittleness and wide temperature-tolerance range, among other criteria. "The whole packaging concept of the Sensar line is not only to provide a unit that is small and attractive, but also rugged," Gilmore continues. "If you take it apart, you'll find things like reinforcing ribs on the housing and shock-isolation pads to protect the more fragile components."

At a suggested list price of $329, the numeric-display Sensar will carry Cadillac pricing in its market segment. But Motorola thinks the numeric display and other features, coupled with the Sensar's shirt-pocket convenience, will overcome its premium price.

In an overall market that is growing by about 15% to 20% annually, numeric-display pagers are currently the hottest segment, industry sources say. "We're definitely seeing display pagers moving in a strong way," notes Renee Harmody, national account manager for U.S. Paging Corp., a division of Graphic Scanning Corp., Teaneck, N.J. The firm ranks among the largest radio-common-carrier pager suppliers, with over 300,000 units in the field. At Metrocall of Delaware Inc., a radio common carrier in Alexandria, Va., vice president and general manager Stanley L. Krejci reports that numeric-display pagers are outselling tone-only units by an 8:1 margin. *–Wesley R. Iversen* of its troubled operations, such as its five-decade-old Geophysical Service Inc. (the company that was renamed TI in 1951) or the sputtering Data Systems Group, in Austin, Texas. Junkins will not discuss such possibilities. "I don't want to be boxed in to either having to do something or not being able to do something," he says. "That's the job that the management team has taken on, and it is proceeding very well."

HIGH-GROWTH MARKETS. While Junkins views TI from top to bottom, repositioning efforts initiated by corporate mandates four years ago are shifting the company's focus from high-volume commodity businesses—which flourished in the 1970s—to what it hopes will be the high-growth markets of the late 1980s and 1990s, such as high-speed CMOS, application-specific ICs, and AI.

Veteran TI chip managers say the swift pace of repositioning its the company's huge semiconductor line is unlike any other of its corporate moves since it helped pioneer IC production 25 years ago. After a late start in CMOS, TI has placed the technology into nearly all its product catalogs in the last three years.

It is now gearing up to accelerate use of its latest CMOS technology, a 1-μm process used to fabricate prototypes of a 1-Mb dynamic random-access memory. As they do, MOS managers in Houston plan to break tradition altogether by leapfrogging a generation of technology—that of 256-K DRAMs—to bring out logic devices in the new 1-Mb technology.

In the coming years, TI will also quickly apply 1-μm megabit-class design rules to its standard-cell line, which is moving from 3- to 2-μm CMOS. Developed with 1-μm CMOS in mind, TI's standard cells will equal high bipolar speeds when converted to the 1-Mb DRAM process. In Dallas, meanwhile, an team continues its work on smart high-voltage ICs, which could signal the company's return to an active role in power semiconductors.

In addition to its aggressive push into VLSI technology, the company is attempting to rally all its businesses—from oil-search services to factory automation systems to electronic warfare equipment—around a push into AI research, which it began seven years ago. Already, TI has an impressive list of products and prototypes that this double-edged thrust should produce in the next 18 months or so (see "TI's impressive work list," right).

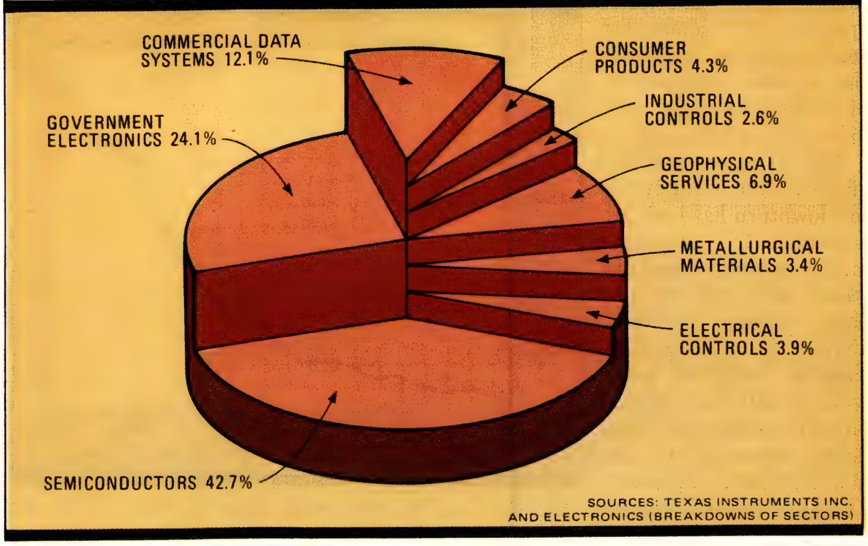
Despite the company's solid-state prowess and its four-year effort to reposition the bulk of its products in faster-growth electronics markets, most TI observers believe the company's long-term turnaround depends heavily on Junkins. To analysts tracking the firm as well as to many former TI managers, Junkins's successful navigation of TI through the rest of a difficult decade hinges on the freedom to make strategic decisions.

"The big question here is whether or not the board and [chairman] Mark Shepherd Jr. will give Junkins the flexibility to make his own mistakes," says analyst Adam Cuhney of Kidder Peabody & Co., New York. "Frankly, I'm not optimistic about the situation. Naming Junkins to the post was an encouraging move. Still, TI seems to lack the recoverability potential that other firms possess. I would reluctantly push TI into the category of a past mighty—such as a Xerox, a Fairchild, or other yesterday-growth firms—but it is right on the very edge of a fall into that camp."

Evidence of TI's precarious position continues to surface through a rocky first half of the decade. Although total revenues have grown steadily—$4 billion in 1980 to a record sales of $5.7 billion last year (see chart, p. 24)—TI has suffered three quarterly losses in the past two years. Those three deficits were the company's first in three decades of business.

In the quarter ended June 30, TI reported not only a loss of $3.9 million but

SEMICONDUCTORS DOMINATE TI'S $5.7 BILLION 1984 SALES



SOURCES: TEXAS INSTRUMENTS INC. AND ELECTRONICS (BREAKDOWNS OF SECTORS)

TI's IMPRESSIVE WORK LIST

For the rest of 1985 and next year, TI has laid out an ambitious list of goals for itself as it seeks to leverage its technological developments in very large-scale integration and artificial intelligence. Among other goals, TI expects to:

- Aggressively reenter the market for erasable programmable read-only memories by unveiling a low-power 256-K EPROM and new CMOS technology aimed at eventually achieving megabit densities.
- Start volume sampling of its 1-μm CMOS megabit dynamic random-access memory.
- Accelerate the introduction of a family of advanced high-speed CMOS standard logic based on the 1-μm megabit technology.
- Ready a new line of customer-configurable single-chip 8-bit microcomputers, codenamed Roadrunner (development was initiated for a U. S. automaker).
- Unveil a five-chip set as an interface to the long-awaited IBM Corp. token-ring network.
- Expand its 32-bit 32000 microprocessor offerings, second-sourced from National Semiconductor Corp.
- Introduce a next-generation oxide-isolated bipolar process (dubbed Impact-X), aimed at still higher-scale integration of fast TTL circuits.
- Enter high-speed emitter-coupled logic.
- Debut a commercial line of 32-bit minicomputers that can tap into AI packages developed on TI's year-old Lisp-based Explorer work station.
- Release for prototype production this summer a 32-bit Lisp-language microprocessor made from double-level metal, 1.2- to 1.5-μm CMOS. The 228-pin chip will have some three quarters of a million transistors. TI researchers hope to have working parts by the end of the year.

–J. Robert Lineback

return on investment," says Michael J. Krasko, an analyst for L. F. Rothschild Unterberg Towbin, in New York.

"TI's technology profile remains pretty well intact, but one of the issues facing a guy like Junkins, after heading Government Systems, is can he adjust to the fast-paced changes of TI's other businesses—like semiconductors," he continues. "TI has always had great technology, but for the past 10 to 15 years it has experienced trouble converting it to the market."

Junkins says the company is attempting to become a better marketer—as is the entire industry. "The most important thing is that once we have decided [on the businesses], our job is to understand where we want to go, are going, and be darn sure that we have got the resources in place—both product development, marketing/sales, distribution, and services. We are in more than one business and they each have different facets. Our strengths, and our weaknesses, are different from business to business."

At Hambrecht & Quist, San Francisco, John J. Lazlo Jr. believes TI's repositioning effort is one of "reviving what was until the mid-1970s a great American corporation that pioneered virtually everything that it did—whether it was oil exploration, semiconductors, or some of the first consumer products, like Speak & Spell. TI has been drained of some innovation and drive. Management now has the challenge to revive TI and make it once again a great company."

TI's focus is shifting from commodity chips to high-growth markets

Part of that revival attempt was launched in 1982 after top executives began trimming an unwieldy matrix management structure, which had tangled TI after the company crossed the $3 billion mark in 1979. In addition, chairman Shepherd and then-president Bucy started the aggressive campaign to refocus TI's attention on semiconductor development in an attempt to get back to the basics that had made TI the leading volume chip maker.

But though management and corporate organizations continue to change in the 1980s, many at TI believe the firm is about to have its chance to reap the key benefits of two separate but potentially related technology thrusts: AI and VLSI.

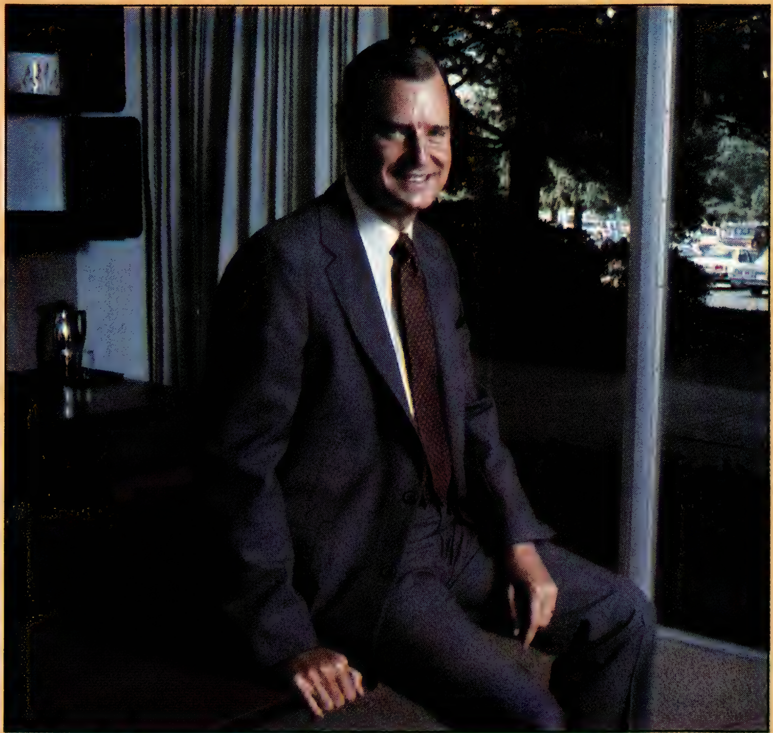
"Our two biggest research investments today are in VLSI and AI, and we see a strong degree of synergism between the two. We think that VLSI is the enabler for practical AI," explains chief technical officer George H. Heilmeier, senior vice president of corporate research, development, and engineering (see "TI looks for a successor to the transistor," p. 24).

Part of that teaming of the two R&D goals is coming together in TI's design of a CMOS Lisp processor chip, which this month enters fabrication for prototyping. The chip, which is roughly 10 times more complex than Motorola Inc.'s 68000 microprocessor, is the focus of a $6 million contract awarded by the Navy Electronics Systems Command and the Defense Advanced Research Projects Agency, in Washington. The 32-bit Lisp processor chip will measure

TI AIMS TO STRENGTHEN ITS PRESENCE IN JAPAN

Before Western chip suppliers can establish a strong manufacturing presence in Japan, they must be willing to spend as long as 10 years creating close ties with the nation's universities, says William N. Sick, president of TI's Semiconductor Group. TI—which counts its three Japanese semiconductor plants (in Miho, Hatogaya, and Hiji) as major competitive assets—will soon take steps to do chip research as well in the island nation.

GRADUALIST. Slow and steady wins in Japan, says William Sick.



"It is the next gradual step," says Sick, referring to TI's research facility planned for Tsukuba Science City, north of Tokyo. Since the start of the 1970s, TI has led all other Western companies in building semiconductors in Japan. Now the intent is not only to tap Japan's manufacturing know-how but also to draw on the emerging product-design talent.

"In Japan, you have to grow an organization out of the universities. The very best people come out of the universities and go to work for a company to stay," notes Sick, a corporate executive vice president who was elected to TI's board last month. "It takes 5 to 10 years to build those bonds, and you must have a senior Japanese staff even to do that."

TI's chip-making plants in Japan have already served up two types of side results. "Japan is providing a very important window in serving the growing semiconductor customer base in Southeast Asia," Sick says.

The plants also have provided some competition with front ends in Texas, says Timothy B. Smith, semiconductor senior vice president heading MOS memory and processor operations in Houston. TI constructed twin 6-in.-wafer fabrication plants in Dallas and in Miho last year, pitting U. S. facilities contractors against those in Japan. Both were completed and the first 256-K chips produced in less than a year. **–J. R. L.**

Group (see "TI aims to strengthen its presence in Japan," p. 25). "It gives us a set of tools for the semiconductor operation, both in making components and in designing products that will eventually go into the AI applications."

Part of a revolutionary change in chip markets could be an explosion in application-specific ICs. To adjust to the challenges of manufacturing customer-defined chips in many different quantities, TI has set up a network of automated controls and work-in-progress tracking systems to help enable just-in-time delivery. Delbert A. Whitaker, semiconductor senior vice president in charge of standard and semicustom logic, says that though the emerging ASIC business initially emphasized the software with which the customer designs ICs, the trick now is to shift into a manufacturing-oriented business by 1987-88.

"All of a sudden, instead of having 1,000 gate arrays in our plant, you will have 10,000 different standard-cell designs. People are going to have to keep track of these large quantities of different design codes," Whitaker says.

Knowledge-base systems are also likely to play a larger role in TI's goal to achieve 90% first-pass design success in VLSI, says Gollapudi R. Mohan Rao, semiconductor vice president and man-

MONEY-MAKING DEFENSE GROUP GIVES TI PROFITS AND PRESIDENT

TI's Defense Systems & Electronics Group—until late July called simply the Equipment Group—continues to be the company's most consistent money maker in an otherwise turbulent decade for the corporation. The Dallas unit traditionally contributes about a quarter of TI's total annual sales; in 1982, it pushed its own revenue past the $1 billion mark.

But this year it provided more than just sales, giving the corporation a new president and chief executive officer as well. For a decade, Jerry R. Junkins had responsibilities in TI's growing military-systems business and was corporate executive vice president in charge of the operation when he was suddenly promoted at the end of May.

The operation continues to provide strong incentives in a number of TI technology thrusts. These include artificial-intelligence systems, Lisp-based microprocessors, gallium arsenide devices, submicron components spawned partly from its work in the military Very High-Speed Integrated Circuits program (VHSIC), and a number of key breakthroughs in radar systems, such as technologies aimed at solid-state phase-array radar.

Six of TI's seven VHSIC chips—developed under the Defense Department's Phase 1 program—are rolling through a new fabrication line in Dallas. The facility has Class 1 clean rooms containing less than one particle larger than 0.3 µm per cubic foot of space. The line is now averaging 700 wafer starts a month.

TI's seventh VHSIC chip, a general buffer unit, is scheduled to enter fabrication by the fall. The defense systems group is also planning to start fabricating several new VHSIC-class CMOS chips later this year. The VHSIC chips will be marketed by the Semiconductor Group's Military Products Division, in Midland, Texas.

For the group, 1985 could be a year of flat to moderate growth, largely because several of its major military-systems programs will move to new phases of volume production. In June, TI received a huge follow-on order for 1,571 high-speed antiradar missiles, known as Harm. This $462.1 million pact followed a $60 million first-year contract awarded in March.

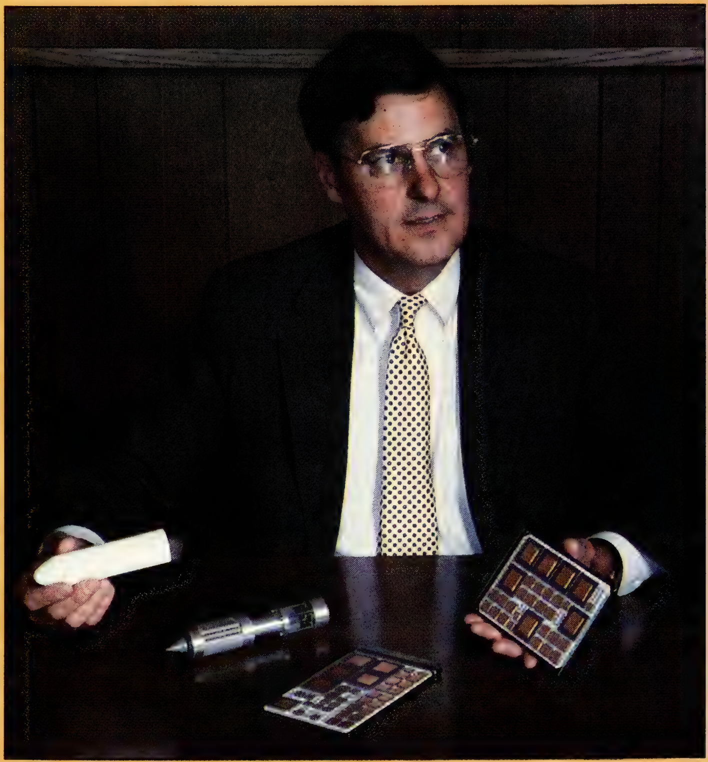
The Harm missile program, with an estimated lifetime value of more than $5 billion, represents TI's strongest entry into the defense prime-contracting arena. The bulk of its business traditionally has come from electronic-subsystem contracts. In order to remain a sole source on Harm, TI has committed itself to three years of fixed price reductions. In return, the government has agreed to add a year of orders automatically to the contract for each year that TI meets its price goals. "Over the first three years, we have been on a better than 80% learning curve and that's very steep," says group president William B. Mitchell. A Harm missile today costs about $285,000 per copy.

"We will continue to go after selected prime contracts. However, we do not have a strategy to become just a prime house. We do have a lot of capabilities that many primes don't, and many of them have to go outside for the work."

The group is making a number of new forays into applied AI. Under a recently awarded contract to it and the Central Research Lab, it will develop an expert system to counsel naval commanders in battle management. The program, called Force Readiness Expert System Hawaii, is part of the Defense Department's Strategic Computing Program and will be implemented initially in the Pacific Fleet. TI is also bidding on a contract to develop AI for a pilot's "associate" under the Strategic Computing Program.

"As we get more visible in the defense-systems marketplace, it will become a different kind of business for TI," notes Mitchell, referring to the increased attention his group has been getting lately from competing prime contractors. —J. R. L.

REVENUE MAN. William Mitchell heads TI's profitable military group.



tween commodity 64-K technology (with 3-μm design rules) and the megabit process is 10-ns external gate delays *vs.* 3-ns delays for the 1-μm design rules. TI expects the internal gate delay of 1-μm CMOS to be less than 1 ns.

In addition to the DRAM-driven thrust into VLSI, TI plans to launch a second processing effort this month aimed at erasable programmable read-only memories. Just as with DRAMs, the EPROM effort will be the processing driver for high-voltage CMOS technology. An advanced-CMOS EPROM process can be applied to linear products, Smith says. "It also lets you build MOS PALs"—a version of the programmable-array-logic device originally pioneered by Monolithic Memories Inc. "And the advanced EPROM process is very close to electrically erasable PROMs."

The overall shift to emerging chip products is also changing the way TI tracks market demand. Instead of relying heavily on commodity-chip volume projections, TI last year initiated a program called DIG, for design-in goals. DIG is an attempt to closely match design wins with expected product shipments.

In semiconductors, the accent will be on premium products

"Many times, you are developing products and you think you are doing great things. It might take you a while to realize it is not getting designed into the market," notes Bruno Pagliuca, vice president and director of worldwide semiconductor marketing in Dallas. "We are doing this because we have long-range and intermediate plans to increase the number of what we call premium and system products as a percentage of our total products. It is an effort that comes from a realization of our shortcomings in not developing enough business in these products. We have realized that, and we have been working very hard in the past two to three years. We have developed more premium products in that time than in the previous 10 years." *–J. Robert Lineback*

TI SEISMIC-SEARCH SUBSIDIARY PROSPECTS FOR OIL IN CHINA

Like an uncapped gusher, rumors continue to flow about Texas Instruments' long-term plans for its troubled oil-search subsidiary. Geophysical Service Inc., now more than 50 years old, launched TI in the early 1950s as an effort to join the unfolding solid-state revolution.

In 34 years, its offspring grew to nearly 15 times the size of its creator. Now, in the midst of a persistent world oil glut, electronics analysts question TI's tight grip on money-losing GSI. One reason for holding on: many top TI executives started out there and still have strong emotional ties to GSI. Attempting to quash the rumors, TI last month issued a statement denying that any operations were up for sale.

Grant A. Dove, executive vice president overseeing GSI as well as computer-system products and industrial controls, thinks the oil-search operation can still play a vital role in leading TI into new technologies and international markets. In earlier times, TI used the expertise it acquired in computerizing seismic-data acquisition and new processing systems to carve a niche in the minicomputer market.

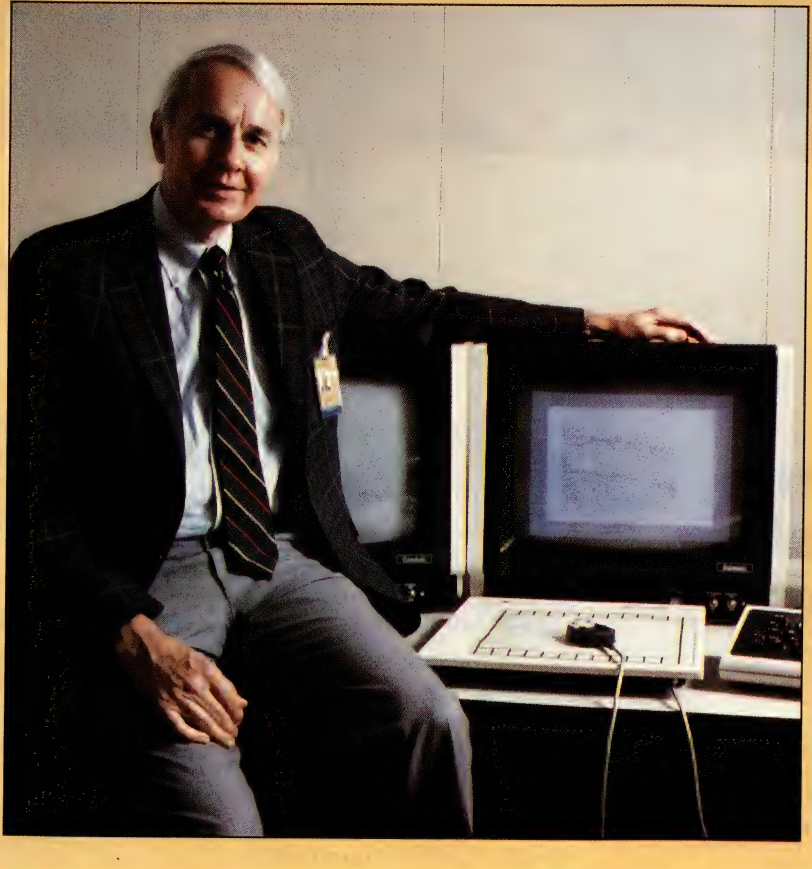
"Geophysical Service is a potential big, early user of artificial-intelligence technology," notes Dove. "And with all of the things that we know, we are still not able to tell what's inside rocks below—it could be oil or water. We think we know how to solve the problem, but we need a lot more processing efficiencies and better signal-to-noise ratios in collection systems as we start looking for smaller and smaller reservoirs."

GSI's fleet of 20 ships—affectionately called the TI Navy—is starting to use accurate satellite global positioning systems, developed by TI's Defense Systems & Electronics Group, while it collects three-dimensional display data.

Meanwhile, the geophysical subsidiary continues to increase its presence in China—a huge potential electronics market for TI's equipment and semiconductor operations. TI has been active in the search for oil in China since the late 1970s and now has seven seismic crews and five data-processing centers there. In addition, GSI has licensed the Chinese to manufacture a digital seismic recording system; the China assembly plant opened in June.

"China is a large country, but word gets around that we are a solid contributor to their petroleum programs," states Dove. "It's a situation where GSI and GSD [the subsidiary's Geophysical Systems Division] are helping to pave the way for TI to develop other potential markets, which will be important in the years ahead." **–J. R. L.**

LOOKING EAST. Grant Dove's GSI group sees great market potential in China.



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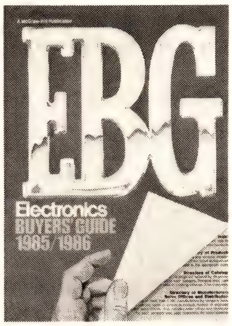

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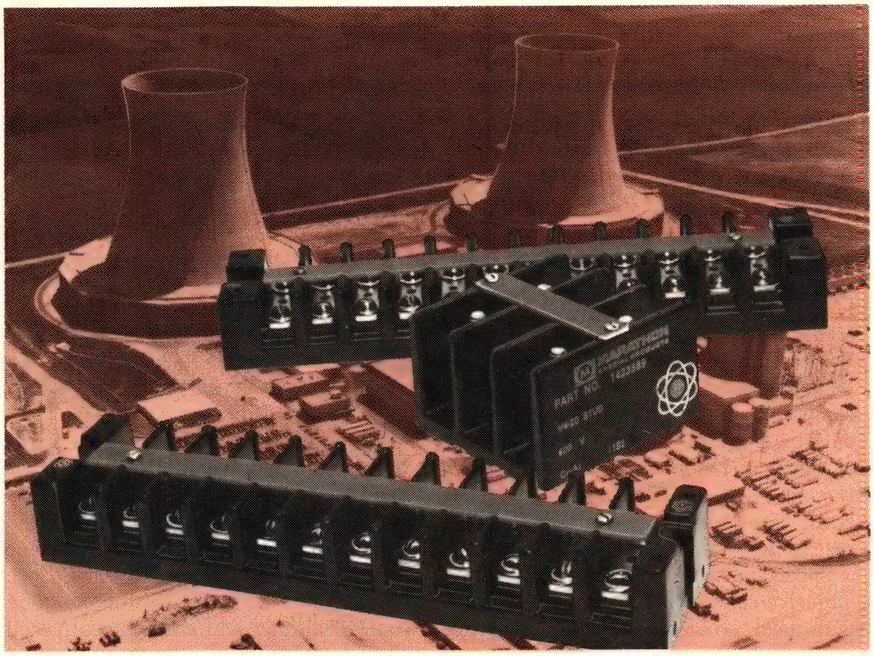

Plenco's 02000 and technical support helps Marathon maintain Nuclear Regulatory Commission certification for their NUC devices

Marathon Special Products, Bowling Green, OH, a subsidiary of Marathon Electric Manufacturing Corp., designs, engineers and manufactures high quality wire termination and circuit protection devices for the electrical and electronic component industry. Their NUC devices are used in nuclear generating plants throughout the country.

Marathon engineers explained, "Formerly, many nuclear plants used circuit devices made with unproved thermoplastics. They were unsatisfactory. To gain certification by the Nuclear Regulatory Commission for use within reactor containment areas, our NUC devices were subjected to an exhaustive series of tests for radiation aging, reactor coolant loss, earthquakes and other emergencies. With Plenco's 02000 molding compound and technical support we gained several advantages. Plenco's compound is tough enough to pass the tests and still give us good processability."

The result, according to Marathon's marketing department, "Our NUC line is now qualified to meet the NRC and IEEE requirements and nuclear generator operating utilities are retrofitting with our NUC series terminal blocks to help provide an additional safety factor."

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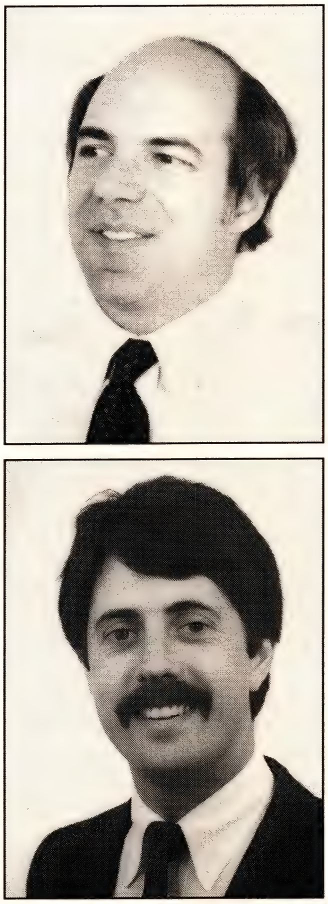
inal-equipment manufacturers. Hurtig sees this as a sign the young company is "building a channel of distribution," a vital ingredient to making good technology turn a profit.

Senior analyst Beth Tucker of Dataquest is also impressed by the company's marketing strength. "Of two unique features of the company," she says, "one is the number of MBAs there. There are about 25. They're paying very close attention to marketing." She says this indicates that "this is a company developing products for a solution. In many companies, you have solutions looking for a problem. I think they will avoid that situation." But the company must stay on target.

The other unique feature of the company is their "strong in-house design tools, so they can implement applications," Tucker says. "That's different, that's unique."



FASTER. Performance is the key for Silicon Solutions, say chairman John Newkirk (top) and marketing director Geoffrey Mott.

Silicon Solutions' design methodology was put to the test in a custom-IC contract with Kurzweil Applied Intelligence Inc., Waltham, Mass. According to Newkirk, Kurzweil claimed that National Semiconductor Corp., while not known for its custom work, could put one processor on a chip and do it in one year. Silicon Solutions put eight processors on a chip and did it in six months—and at a much lower cost. Kurzweil is using this chip, the KSC 2408, to develop a voice-actuated typewriter.

One major computational bottleneck in CAD that Silicon Solutions identified centered on the IC design mask. This gave rise to an accelerator for the layout environment. The marketing department advised a low-cost (under $100,000) system that could run on a large installed base of layout design systems. Silicon Solutions came out with the Fast-Mask Engine. Newkirk says his company's board replaces the comparable Zycad box, which is built with standard parts and sells for $500,000.

The engine and its new accelerator run on the GDSII layout system from Calma Co., Santa Clara, Calif. Dataquest estimates that the GDSII system had 42% of the IC CAD work-station market last year. Silicon Solutions claims the engine runs up to 60 times faster than the original Calma equipment and verifies designs in the background so it does not tie up the layout system's central processing unit.

"We ran benchmark design-rule tests with competing software on a custom IC design with 40,000 transistors," says Geoffrey Mott, director of computer-aided-design and -engineering marketing. "The test took between 8½ and 72 hours using software on a minicomputer, depending on the particular software package. The basic Fast-Mask Engine took under nine hours. With our accelerator, the Fast-Mask engine does the same job in 1 hour and 20 minutes."

Expanding in the CAD arena, the company's newest product is the Mach 1000, a logic and fault simulator for IC and printed-circuit-board designs that accelerates software developed by H. H. B. Softron Inc., Mahwah, N. J. The Mach 1000 performs simulations of 10,000 gates in less than a minute, compared with up to a day for similar performance on a VAX-11/780 minicomputer from Digital Equipment Corp. "The first people that knocked on our door for the machine were the Japanese," says Newkirk.

The design advantage shared by the company's two simulators—and what saves them from quick obsolescence—is their ability to accept hardware updates as frequently as software. "Where we really win is in our ability to modify our design," Newkirk says. Silicon Solutions engineers can just unplug the custom chips in their products in the field and install the new versions.

Although the company managed well with Newkirk as president, Thomas J. Popek was named president and chief operating officer on Aug. 5. Popek, previously senior vice president and general manager of the components division of Zilog Inc., Campbell, Calif., also spent two years at Memorex Corp. and 15 years at Fairchild Camera & Instrument Corp. "I need to spend my time, full-time, on long-range strategy," Newkirk says. "I'm going to see where we're going—Popek's going to make sure that we get there." *–Eve Bennett*

BOTTOM LINES

SANYO, ICON SET SUPERMICRO EFFORT

Sanyo Electric Co., Osaka, Japan, has struck a deal to acquire 40% of Icon Systems & Software Inc., Orem, Utah, for an undisclosed amount. The two companies say Icon will expand its research, development, and design of a 32-bit supermicrocomputer that incorporates multiple microprocessors and multiple concurrent operating systems.

The initial product is a 32-bit multiuser, multitasking computer based on dual Motorola Inc. MC68020 microprocessors, the companies say. The machine, with a rated speed of 3 million instructions per second, will allow the concurrent use of standard operating systems, including AT&T Bell Laboratories' Unix System V and MS-DOS. It will sell for under $20,000. Each company will manufacture and sell the equipment in its own country.

CDC-NCR VENTURE SELLS A FACTORY

Computer Peripherals Inc., Norristown, Pa., has sold its Campton, Ky., factory to Campton Electronics Manufacturing Inc., a startup formed by executives at the plant. Neither company would disclose terms of the sale. Computer Peripherals, a joint venture between Control Data Corp. and NCR Corp., makes tape drives. It says the Campton plant now manufactures printed-circuit boards, cables, wire harnesses, and other subassemblies for Computer Peripherals and for Centronics Data Computer Corp. Campton Electronics will continue to supply subassemblies to Computer Peripherals under a two-year purchasing agreement. Computer Peripherals says sale of the Campton plant is part of its efforts to cut costs and to consolidate its operations.

INFINET COMPLETES REFINANCING PLAN

Infinet Inc., a privately owned company in Andover, Mass., has completed an $8 million refinancing plan, which consists of a private offering of subordinated debt to its investors. The company plans to use this capital to expand its credit lines with its commercial banks and lease-financing sources. Infinet president Nick Papantonis says the new plan "provides Infinet with sufficient funds to continue the development of Infinet's product line." Infinet, which began in 1969 under the name of Intertel Inc., makes network control and management systems for the data-communications market.

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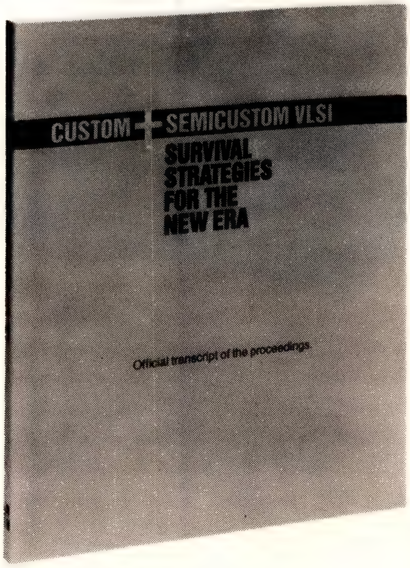
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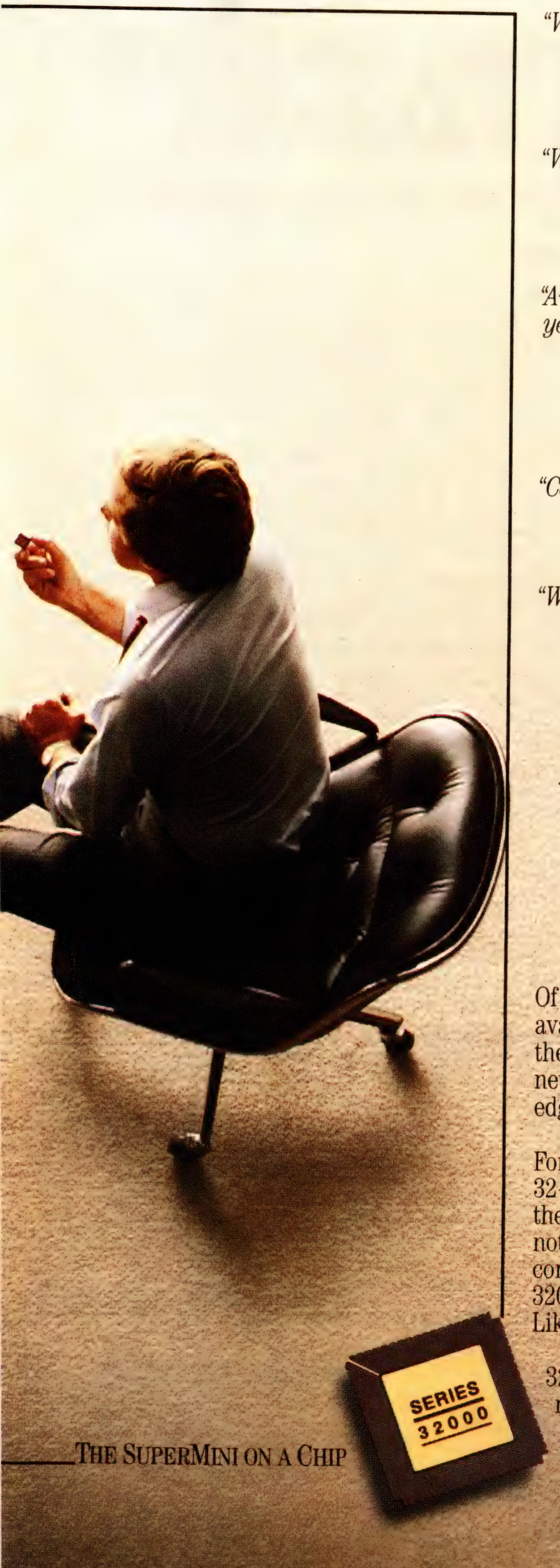

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In the gull-wing configuration, the solder joints can be easily inspected on the pc board after attachment. In addition, because the leads are conveniently located, the chip carrier is more testable. The J-bend package, because of its lead configuration, is more rugged. Because the leads bend inward, rather than outward, the package's footprint is all that need be accounted for during board design.

An alternative to leaded packages, the leadless package uses solder bumps that are mated with solder paste during reflow. The bumped packages are open-framed, or unencapsulated, so a technician or test engineer can access the component after the chip has been mounted in a system for active trimming. According to Allen-Bradley's Blanchard, the open-frame bumped packages will not replace plastic leaded packages because its unencapsulated nature limits uses.

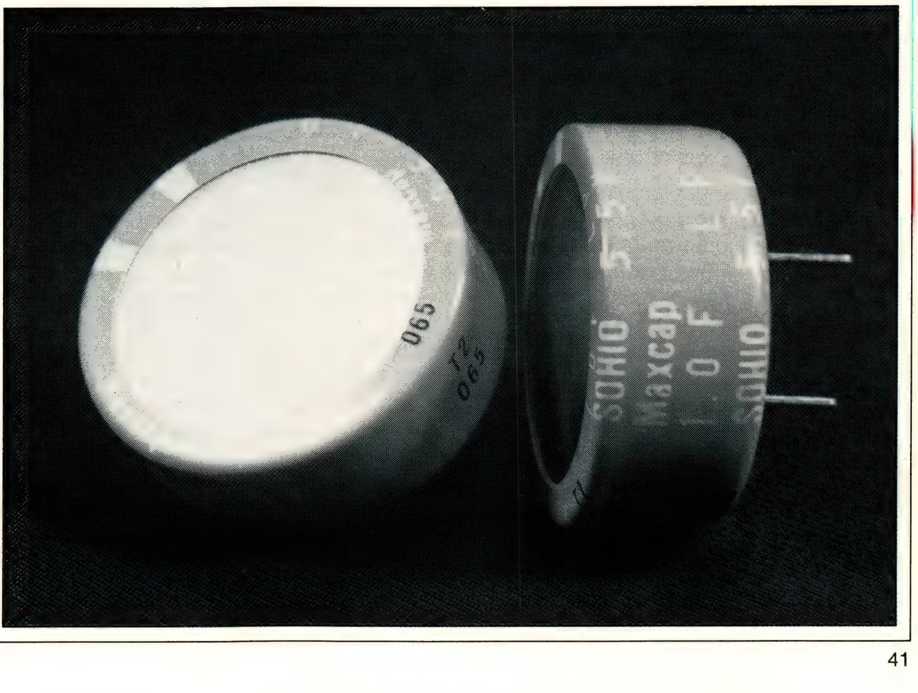
Even with the packaging dilemma unresolved, surface-mountable devices are grabbing a bigger share of the passive-component market each year. In 1985, about 20% of the roughly $600 million ceramic-capacitor market—the largest passive-component sector—will be surface-mount parts, according to market researchers Gnostic Concepts Inc., San Mateo, Calif. In five years, surface-mountable ceramic capacitors will reach sales of $400 million to $450 million, Gnostic says.

Of course, the growth picture isn't entirely rosy. For one thing, the current computer market slump has cut into sales. A good example is multilayer ceramic capacitors, which account for about 30% of the U.S. capacitor market, according to Gnostic Concepts. In early 1984, Gnostic predicted that the market would grow 20% to 40% a year. But the big inventory buildup and slump in demand caused sales to decline about 10% over last year. Prices are dropping drastically, and some Japanese manufacturers are selling products below cost to keep their market share and to help meet overhead costs.

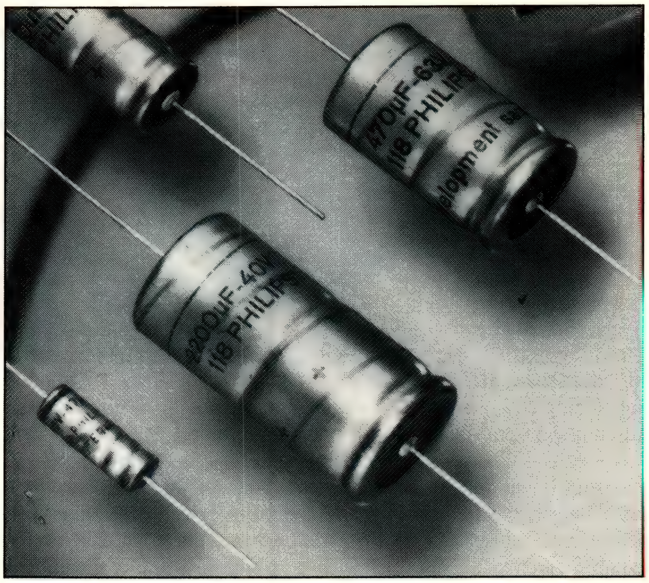
Clean and refreshed memories

One sector in which technological innovation is pushing surface-mount development is capacitors. As designers have boosted the density of memory chips—up to 256-K and beyond—the current required for computer systems has increased. That is, restoring the charge on dynamic storage cells during refresh can require peak currents from 50 to 200 mA. Heightened current calls for more decoupling, particularly in dynamic random-access memories, which are especially sensitive to coupling-induced soft errors. Decoupling capacitors must have excellent high-frequency characteristics, and they must introduce low inductance and resistance.

So AVX Corp., Myrtle Beach, N. C., has introduced the Bitguard, a surface-mounted decoupling capacitor shown in Fig. 1, which minimizes inductance and equivalent series resistance, causing a voltage drop across the memory chip. It fits next to the RAM package, reducing the equivalent series resistance and inductance. "The trick is to present the current to the memory cell quickly with no voltage bump—that could appear as another piece of information," says John Maxwell, marketing manager of AVX's Integrated Capacitor Division, Great Neck, N. Y.



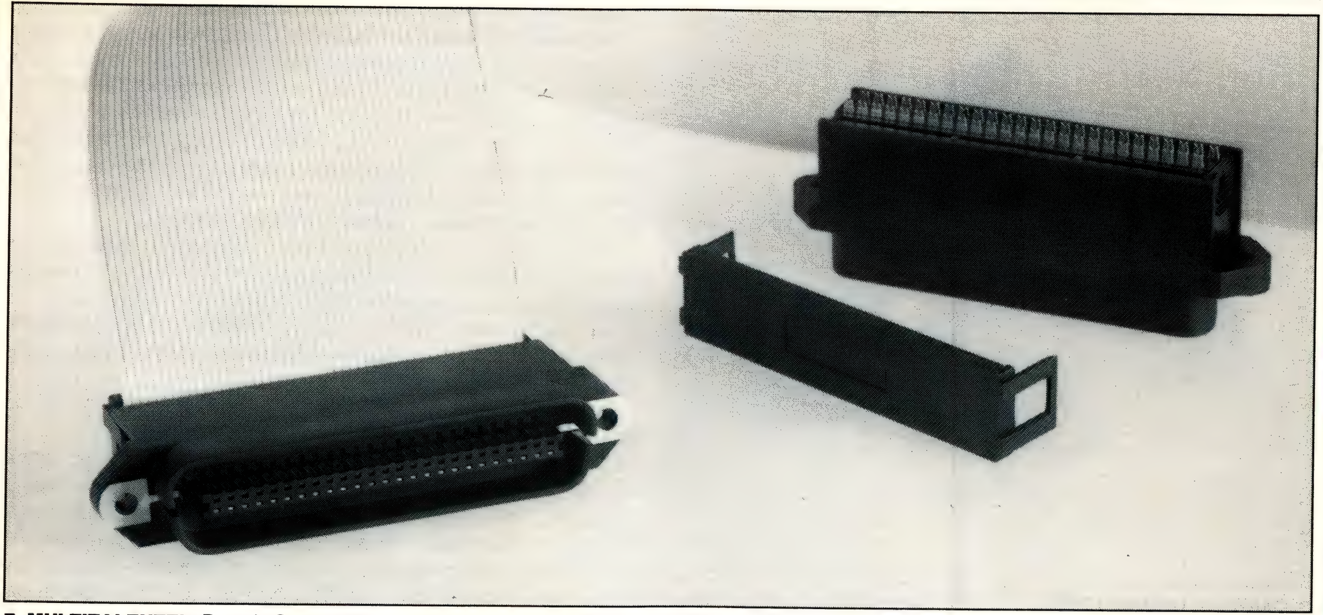
5. BATTERY CAP. Maxcap, from Sohio Engineered Materials Co., is a line of double-layer capacitors with energy densities 100 to 500 times greater than those of low-voltage aluminum capacitors. Depending on system load requirements, the charge will remain up to 1,000 hours.



4. HOT CAP. The high-temperature aluminum electrolytic capacitors from Philips Elcoma suit telecommunications and military applications. At 125°C, the capacitors last 2,000 hours; but at 40°C, they last 450,000 hours. The nominal capacitance range is 1 to 15,000 μF.

Surface mounting was not the original choice for the Bitguard package. AVX had thought that the memory-chip manufacturer would encapsulate the decoupling capacitors with the IC in the package. But encapsulation was too expensive and the increased complexity could drop the yield in IC production, says Arch Martin, AVX staff marketing manager. Now the system maker attaches the Bitguard when the IC is soldered to the printed-circuit board. The guard can be mounted beneath a plastic leaded chip carrier in the void for the leads or on the back side of the pc board or substrate when other surface-mount components are used in thin high-density modules.

Surface mounting also is showing up in more conventional capacitors. For example, Vitramon Corp., Bridgeport, Conn., has moved into ceramic surface-mounted chip capacitors, says Richard Soltis, application engineer. These capacitors are stable, rugged, and compact. Multiple-layer ceramic capacitors are made from processes derived from thick-film technology, which is characterized by successive screen printing and slip



7. MULTITALENTED. Burndy Corp.'s filter connector has more than meets the eye. The capacitor array within the connector is an alternative to reducing electrical transients and noise from voice and data transmissions. The connector may be used as a standard transition device.

num, and tantalum are not self-healing, although they handle occasional slight overloads.

Polycarbonate capacitors with extremely stable temperature characteristics and high dielectric quality will go into wide use, probably in 1987, says Kowalkowski. In addition to Siemens, TRW Inc.'s Capacitor Division, Ogallala, Neb., makes polycarbonate capacitors, as do several other European companies including Thomson-CSF of France.

Return from the past

The 100-year-old double-layer capacitor is beginning to make its mark as a high-energy backup device, thanks to the advent of low-current-drain CMOS memories, says Gary Innocenti, product manager for the Semiconductor Products Division of Sohio Engineered Materials Co., Niagara Falls, N. Y. A double-layer capacitor exhibits a capacitive effect such that the application of an electric field results in an accumulation of electrostatic charges in two layers, rather than one.

A double-layer capacitor, such as Sohio's Maxcap (Fig. 5) provides backup power for CMOS ICs in place of lithium or nickel-cadmium batteries. The Maxcap is a sandwich of activated carbon and an aqueous stable electrolyte solution. The high porosity of the carbon results in an extremely large surface area per unit volume, approaching 1,000 m^2 per gram. The electrolyte permeates the millipores of the carbon. When a voltage is applied, the charged particles are free to move around in the carbon matrix. The capacitor can store large amounts of charge because of its high volumetric efficiency.

When power fails, the Maxcap can provide enough current to maintain the contents of the memory, just as if it were a battery. For example, given the typical data-retention voltage range for CMOS RAMs of from 5 to 2 V, the capacitor can provide backup current for up to 1,000 hours. Maxcap can also provide backup power for small motors, alarms, and actuators in equipment such as coin-metering equipment, security systems, starters, and ignitors.

Resistors, which make up only 6.6% of the passive-component market, are appearing in surface-mount versions. Rohm Corp., the Irvine, Calif., marketing arm of Rohm Electronic Ltd., Kyoto, Japan, for two years has been marketing chip resistors exhibiting 1% tolerance. Its surface-mount models come in two standard sizes: the MCR18, which measures 120 by 60 mils, and the more compact MCR10, measuring 80 by 50 mils. Both are 22 mils high and come in two forms: 8-mm cartridge and tape-and-reel packages, the company says.

Rohm also makes resistor networks, or arrays, in surface-mount packages. But Gene Williams, marketing manager for resistive products, says lack of standardization in resistor-network packaging has slowed acceptance of the new products. Original-equipment manufacturers have just recently adopted surface-mount resistor chips and haven't committed themselves yet to resistor arrays or networks.

Williams believes that surface-mount chip-resistor arrays will eventually catch on because they are designed to reduce assembly costs and save pc-board space. Currently Rohm manufactures the resistive chips for the networks on a large substrate, then separates them into units of two, four, six, and eight resistors per package, as shown in Fig. 2.

Another resistor network, from CTS Corp., Elkhart, Ind., comes in a ceramic surface-mount package with its leads driven into the side of the ceramic, as shown in Fig. 3. Thus the entire surface of the ceramic can be used for resistor area, explains Ray Dale, marketing manager. That means higher power dissipation, lower noise, and tighter tolerance trimming. This CTS package has the same outline and footprint as the narrow-body small-outline-IC package from chip makers such as Signetics Corp., the Sunnyvale, Calif., subsidiary of North American Philips Corp.

New opportunities for filters

As circuit speed and densities increase, a big problem for digital systems is filtering out radio-frequency interference, electromagnetic interference, and other types of interference. Moreover, the Federal Communications Commission has established tough standards for rfi and emi emission from digital equipment. Filtering the signal lines as they leave the circuit board sometimes is the best solution. There are several possible ways to do this using multilayer capacitor arrays or filter connectors.

One approach is AVX's discoidal arrays (Fig. 6), designed to filter out emissions from their location within the connector. The signal lines pass directly through the center of the capacitor on the array, and the common ground connection on the array is terminated along the long edges of rectangular arrays and around the periphery of circular arrays. This way, the ground connection of the array is directly in contact with the ground plane of the connector for solid rf suppression.

Currently, AVX can supply an array of 154 capacitors on a

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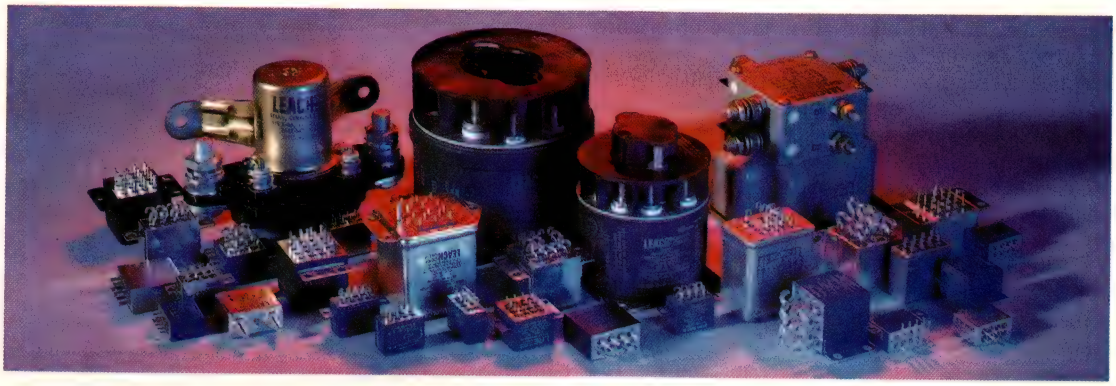


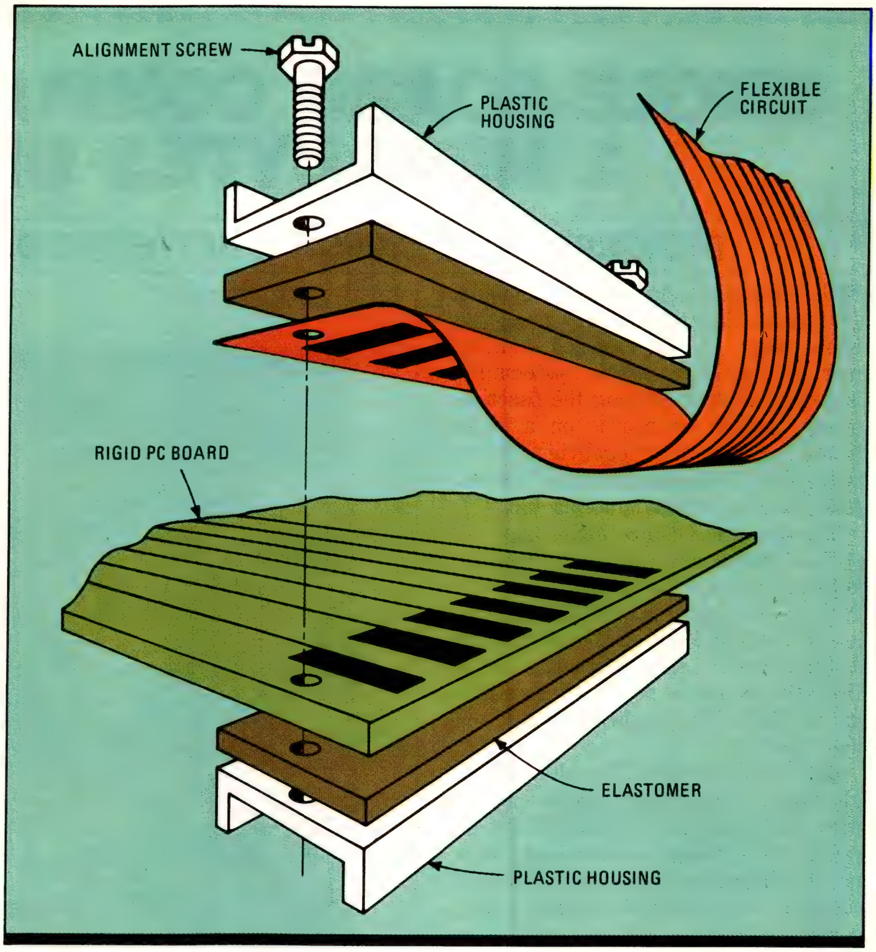
RO-2500's dimensional stability is superior to polyimide's. Processing steps such as etching and heating barely change its dimensions (Table 2). The result is a measured improvement in impedance tolerances as high as 35% at the popular 50-Ω level.

The new fluoropolymer's mechanical properties best those of its closest rival, polyimide with an acrylic adhesive (Table 3). Peel strength, the force necessary to peel off a copper trace, is better in the new film. Another important parameter is water absorption; the new material absorbs one sixth as much water as polyimide, which yields less impedance variation.

Even with RO-2500's superior electrical and mechanical characteristics, impedance mismatches in interboard connections or connectors become critical in the performance of high-speed logic. Rogers's Invisicon connector addresses this problem with a novel solderless, crimpless, direct-connection system.

In an Invisicon connector, the elastomers press the small pad areas on a flexible circuit board against mating pads on a second flexible board or on a rigid board, creating a gas-tight connection. To maintain the continuously controlled contact pressure required, a low-compression-set elastomer functions as a spring. The supporting structure is molded from a plastic with excellent resistance to creep.

This type of connector offers several advantages. These are very reliable electrical connections, clean electrical signals through the connection, high-density interconnections, a small connector profile, and easy assembly and disassembly, according to Bruce Kosa, the company's director of product development. In a flexible-to-rigid Invisicon connection, two silicone elastomeric pieces press gold-plated pads on the flexible cable or circuit against similar pads on a rigid pc board (Fig. 1). Two screws clamp the whole assembly together through a plastic frame.

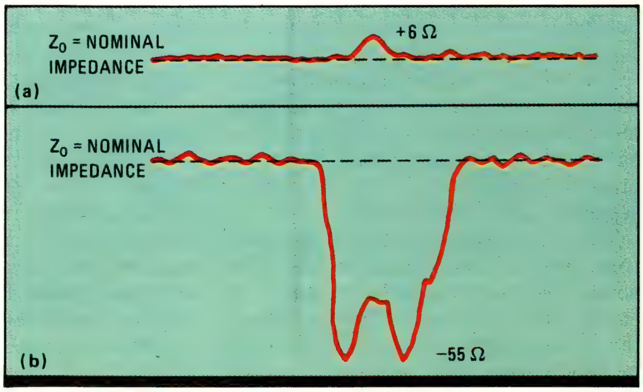


1. INVISICON. Rogers' Invisicon connector is based on a clamped elastomeric connection using each board's pads as connector contacts. In this conceptual drawing, a flexible circuit is connected to a rigid board. A plastic frame and two screws hold the system together.

Extensive testing

Typical pads are 8 mils wide and 80 to 100 mils long; their contact resistance is 4 to 5 mΩ. Rogers has run extensive electrical, physical, and environmental tests on assembled test connectors to evaluate their performance under severe operating conditions.

As noted earlier, an Invisicon-type connector has essentially no effect on a pulse passing through it. A time-domain-reflectometry trace shows the minimal impedance variation (6 Ω) of a Invisicon connector compared with the large (55-Ω) variation of a conventional connector (Fig. 2).



2. TRANSPARENCY. The Invisicon connector is almost transparent to a pulse on a time-domain-reflectometry trace (a). Most conventional connectors cause large discontinuities (b) in high-speed applications.

The performance of the elastomeric clamped connector is no accident. Rogers has generated a computer model that allows its designers to select the actual pad sizes and spaces necessary when a customer requires a certain number of connections in a specific area. At the same time, this model matches the impedance of the connector to that of the board to which it will be mated.

Another major advantage of the Invisicon connector is its contact density, which is limited only by the resolution of the pads on the two boards to be connected and by the precision of the pads' alignment. Currently, backplane connectors based on pins on 100-mil centers can achieve an input/output density of about 37 pins/in. A new surface-mounted connector, shown at this year's Nepcon West show, is based on pins on 50-mil centers and has a density of 63 I/O pins/in. An Invisicon connector based on traces on 50-mil centers has achieved as many as 120 I/O pins/in.

As the density of very large-scale integration chips increases, these chips may require as many as 300 I/O pins. This calls for even denser board and backplane connectors. Invisicon connectors can easily meet these higher-density demands with I/O pins on 25-mil centers or on staggered 12.5-mil centers. ☐

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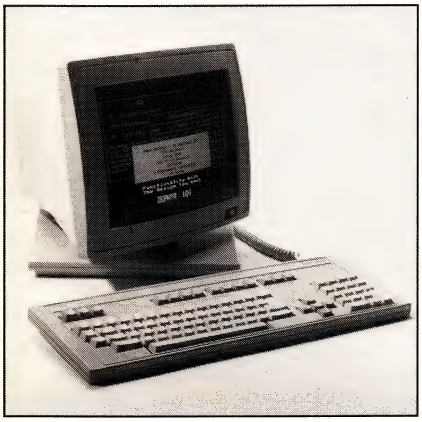
UNITED TECHNOLOGIES MOSTEK

INTELLIGENT TERMINAL EMULATES VT-100

The Zephyr 100 fully emulates the Digital Equipment Corp. VT-100 terminal. Thus it can be integrated into existing VT-100 environments, and operators experienced with the DEC machines need no retraining.

A position lock enables the user to stabilize the terminal's position, which can be adjusted for tilt and swivel. The 14-in. screen comes in both amber and green. The terminal falls midrange between the manufacturer's Zephyr 220 and 52; it sells for $650.



Zentec Corp., 2400 Walsh Ave., Santa Clara, Calif. 95051.
Phone (408) 727-7662 [Circle 359]

PRINTER RUNS QUIETLY AT 53 dBA

For quiet operation in the office, the Paperjet 2000 daisy-wheel printer runs at sound levels of 53 dBA, thanks to the efficiency of its acoustical sound hood. The printer handles both paper and envelopes automatically; it can capture the name and address from a letter, then hold them in memory and print them in position on the accompanying envelope. Thus the operator does not have to make a second print pass for envelopes, a useful feature in large mailings.

A top-of-form optical sensor lets the operator insert the paper anywhere in the manual chute feed and get consistent left and top margins. Switches that must be thrown manually on many models are controlled by software in the Paperjet 2000 and activated from the terminal. These include communications protocols, line spacing per inch, and character pitch. Soft-switch settings remain in nonvolatile memory until the operator changes them.

The suggested retail price of the Paperjet 2000 is $4,495. Delivery is from stock.

Ziyad Inc., 100 Ford Rd., Denville, N. J. 07834. Phone (201) 627-7600 [Circle 358]

MACINTOSH GETS COLOR PRINTING

With the Colormate software package, users of Apple Computer Inc.'s Macintosh can control eight colors for text and graphics created with Macpaint, Macwrite, or other Macintosh software using a similar interface. To print in color, users must connect their computers to NEC's Color Pinwriter, models P2-6, P3-6, CP2, or CP3.

The $99 Colormate package consists of a disk and manual plus an interface cable. It is available now.

NEC Information Systems Inc., 1414 Massachusetts Ave., Boxborough, Mass. 01719. Phone (617) 264-8000 [Circle 356]

LISP SOFTWARE RUNS ON IBM PCs

Developers can write stand-alone Lisp programs for the IBM Corp. Personal Computer with Byso Lisp 1.17 (the interpreter) or Byso Lisp 2.17 (the compiled version). Version 1.17 is compatible with Lisp 1.5, Maclisp, and Common Lisp. It has a full-screen text editor and a structure editor that displays programs in graphics format. The interpreter supports six printing styles, including indentation to show program structure.

Version 2.17, the compiler, runs the sieve of Eratosthenes in 0.45 s; version 1.17, the interpreter, hits this benchmark in 2.8 s. The interpreter uses lexical binding; the compiler supports both lexical and dynamic binding.

Version 1.17 sells for $150 and version 2.17 for $395. An upgrade is $250.

Levien Instrument Co., Sittlington Hill, P. O. Box 31, McDowell, Va. 24458.
Phone (703) 396-3345 [Circle 353]

SOFTWARE SUPPORTS EXPERT SYSTEM ON PC

ADS, an application-development system that supports commercial expert-systems applications development on the IBM Corp. Personal Computer, relieves application experts of procedure so they can concentrate on the rules or knowledge for solving a problem. The software consists of two parts: the Application Building System (ABS), which includes all the development functions, and the Application Execution System (AES), a run-time version for end users.

ADS features an open architecture for the integration of existing data files and applications, rapid debugging, custom-screen development, and password protection. Prices were unavailable.

Aion Corp., 101 University Ave., Palo Alto, Calif. 94301.
Phone (415) 328-9595 [Circle 355]

LISP IMPLEMENTED FOR MACINTOSH

Macscheme is an implementation of Lisp for Apple Computer Inc.'s Macintosh equipped with 512-K bytes of memory. It conforms to the standards for Scheme, a dialect of Lisp. Macscheme supports Common Lisp features such as lexically scoped variables, first-class procedures (closures), macros, and generic arithmetic, including both floating-point and infinite-precision integer arithmetic. This implementation also supports continuations. The interface, similar to Smalltalk, has multiple scrolling windows. The editor clarifies Lisp syntax by highlighting matching parentheses and suggesting proper indentation.

Sold without copy protection, Macscheme sells for $125.

Semantic Microsystems, 1001 Bridgeway, Suite 543, Sausalito, Calif. 94965.
Phone (415) 332-8094 [Circle 354]

INTERFACE LINKS 16 TRANSDUCERS

For motion and dimension sensing in machine-tool and robot controls, the System 16 transducer and computer interface connects up to 16 displacement transducers, proximity transducers, or microswitches to any microcomputer with an IEEE-488 interface bus.

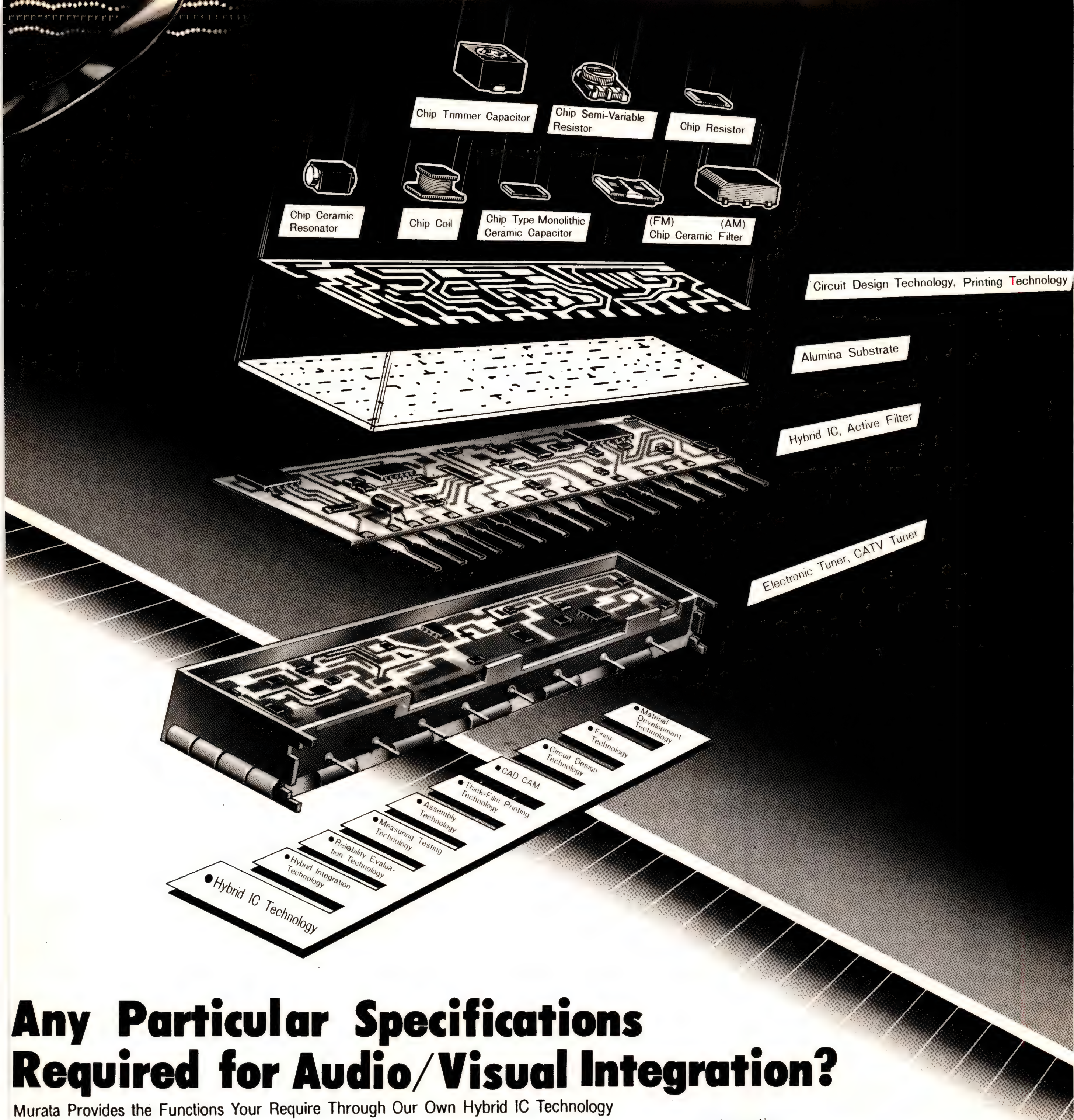
System 16 is easily programmed—a typical scan routine requires just 13 lines of code on Commodore International Ltd.'s model 64 personal computer, or eight lines on Hewlett-Packard Co.'s HP-85 personal computer. The computer controls amplifier gain, scan sequence, and data return.

System 16 is compatible with most other displacement and proximity transducers, including the company's System 256.

Sangamo Transducers, 1875 Grand Island Blvd., Grand Island, N. Y. 14072.
Phone (716) 773-0090 [Circle 360]

DISPLAY HOLDS DATA IN POWER OUTAGES

A series of microprocessor-controlled indicators, Digitec's IQ 280, can display 1- to 5-V or 4- to 20-mA current loop inputs or other process signals in any unit of measure including degrees centigrade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Hybrid IC, Active Filter
Electronic Tuner, CATV Tuner
●Material Development Technology
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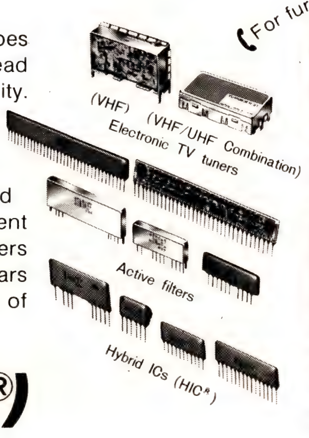

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Circle 64 on reader service card

COMPUTER LETS 3270s DO LOCAL PROCESSING

The ITT applications processor is a multiuser microcomputer system designed to provide local processing to users of 3270 display terminals hooked to mainframes and to voice-data PBX systems users. The processor connects to an IBM Corp. host computer and gives terminal users the choice of communicating on line with the remote host or accessing the ITT system's own local processing power.

The processor provides port connections for up to 32 terminals and printers. Up to 16 peripherals can access the Xenix-based applications within the system simultaneously.

With a single keystroke, 3270 users can toggle back and forth between local application and an active 3270 session with the mainframe. Business applications programs including a relational data base with report writer is part of the package.

Measuring 25 in. by 14 in. by 26 in. deep, the applications processor fits under a desk or table. The enclosure can hold up to 12 Multibus boards, and a 1.2-megabyte floppy-disk drive and 60-megabyte streaming-tape drive.

A basic system sells for $18,500. Shipments will begin in the fourth quarter.

ITT Courier Terminal Systems, 1515 W. 14th St., Tempe, Ariz. 85281.
Phone (602) 894-7000 [Circle 350]

CPU BOARD DESIGNED AROUND 32000 CHIPS

National Semiconductor is targeting a line of single-board computers based on its 32000 microprocessors at computer-aided design, process control, robotics, and data acquisition. The first in the Integrated Computer Modules family is the ICM-3216, which uses the 32016, the 32081 floating-point unit, the 32082 memory-management unit, the 32201 timing and control unit, and the 32202 interrupt-control unit.

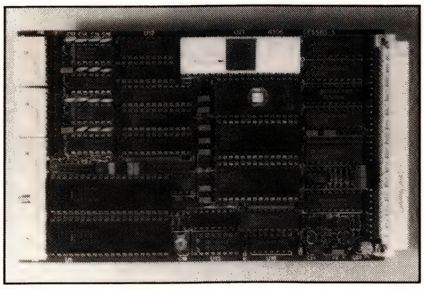
The 9-by-11-in. CPU board also holds four serial ports, a parallel port, a Small Computer Systems Interface for disk drives, and a 16-bit I/O bus. Up to 8 megabytes of memory can be housed on two additional boards. The ICM-3216 sells for less than $3,000 with 1 megabyte of memory.

Also in the works is a CPU version, the ICM-3232, which will contain 2 megabytes of memory on board. It uses the 32-bit 32032 chip, and will be available early next year for under $4,000.

National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, Calif. 95051.
Phone (408) 721-5000 [Circle 364]

SINGLE EUROCARD HOLDS 8088 SYSTEM

A microcomputer system built on a standard single-height Eurocard, the GESSBS-5 contains an 8088 microprocessor plus 24 TTL-compatible parallel I/O lines and 4 16-bit or 10 8-bit programmable timers. A watchdog timer allows the board to be reset in case of a loss of control from the main program.



The manufacturer recommends the board for stand-alone operations, particularly in industrial and process control, but it can also be connected to up to 90 different modules compatible with the company's proprietary G-64 bus. Three empty sockets accommodate a mix of EPROMs and RAMs, with up to 64-K bytes each.

The board also has two programmable RS-232-C serial ports. Because the 8088 microprocessor is also used in the IBM Corp. Personal Computer, programs developed on the PC can be downloaded to the GESSBS-5 board, the manufacturer says.

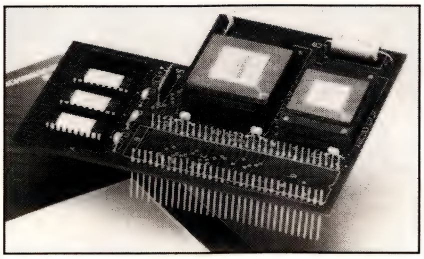
The GESSBS-5 is available now at a price of $595.

Gespac Inc., 100 W. Hoover Ave., Suite 11, Mesa, Ariz. 85202.
Phone (602) 962-5559 [Circle 365]

68020 BOARD PLUGS INTO 68000 SYSTEMS

Dynamic bus sizing, 68000-family communications, interrupt processing, and coprocessor selection are some of the features of an 68020 adapter board that replaces an existing microprocessor by plugging directly into a 68000 socket. The manufacturer recommends the board for prototyping a 68020 design or for increasing the performance of an in-place 68000-based board.

The piggyback board contains a 32-bit 68020 microprocessor, 68881 floating-point math coprocessor, and three programmable logic arrays; it meets all 68000 specifications required to build a 12.5-MHz system. All software for the 68000 and 68010 will run without modification. It uses the system's clock and draws power through the 68000 socket.



The adapter board is priced at $1,875 each. Delivery is from stock.

Computer System Associates Inc., 7564 Trade St., San Diego, Calif. 92121.
Phone (619) 566-3911 [Circle 367]

80286 BOARD SPEEDS IBM PC

Based on the 80286 microprocessor, the Turboaccel-286 board with its faster processing rate gives the IBM Corp. Personal Computer the power to do computer-aided design. The board also performs well with large spreadsheet programs.

The Turboaccel-286 features 512-K bytes of memory and a socket for an optional 80287 math coprocessor. It uses Edsun Laboratories' custom very large-scale integrated circuit for 80286-to-8088 conversion. The chip allows the 80286 to execute the PC's ROM BIOS and PC-DOS operating systems directly, rather than having the 80286 board act as a coprocessor. This approach bypasses the need for special software and eliminates communications problems that would occur when both the 8088 and 80286 are running as coprocessors. The board is software-compatible with the PC and requires no special programming.

Shipments are scheduled to start in early September. The Turboaccel-286 is priced at $995, and quantity discounts are offered.

Earth Computers, P. O. Box 8067, Fountain Valley, Calif. 92728.
Phone (714) 964-5784 [Circle 366]

TESTERS HANDLE BARE AND LOADED BOARDS

The four testers in the series 690, Factron's first bare-board products, can analyze as many as three different boards at a time when configured with additional test cells. The four systems—models 691, 692, 693, and 694—differ chiefly in test-point count, ranging from 2,560 to 32,640 points.

What's more, the testers can be easily modified by users (by replacing the two-wire switching cards with four-wire models) to accommodate loaded boards as well. Furthermore, the system can test both bare boards and loaded boards simultaneously.

Instead of a point-scan technique, the series 690 testers use a group-scan algo-

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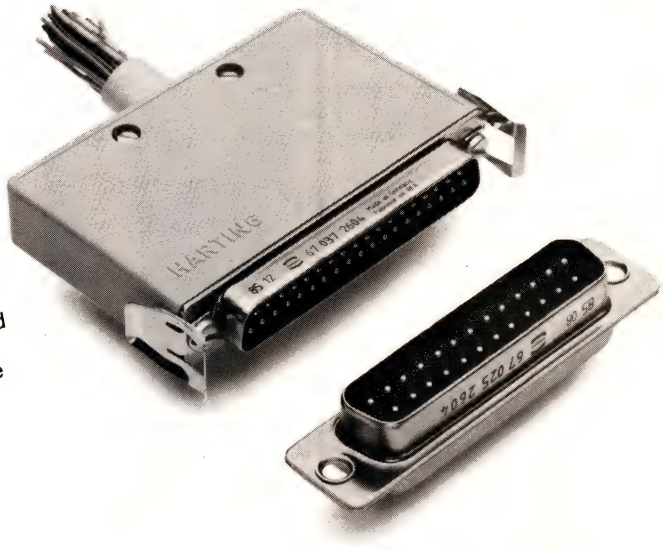

Simply indispensable in office equipment computer engineering, telecommunications and especially measuring and control systems: HARTING subminiature connectors, which comply with DIN 41652*) and MIL-C-24308, meet the very highest demands.

The Advantages:

- High packing density
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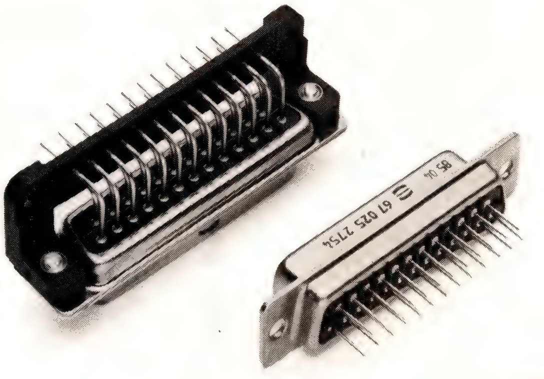
- Optimum screening by ground contact
- Comprehensive range of accessories and up-to-date hood design
- Various termination techniques available to allow efficient assembly
- Selectively gold-plated contacts
- Filter connectors with different filter capacities

Is there anything you're still not sure about? HARTING quality will convince you!

Number of Contacts:	9, 15, 25, 37, 50
Working Current per Contact:	7.5 A max.
Working Voltage acc. to VDE 0110:	125 V A.C., insulation group A
Solder Cup:	Max. 0.5 mm²
Solder Pins:	Straight and angled for 0.8 mm PCB connections
Crimp Connection:	For 0.14 mm – 0.5 mm² stranded wire
Wrapped Terminal:	0.6 mm x 0.6 mm pins
Insulation Displacement Contacts:	AWG 28/7

*) (At present proposal)



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Circle 69 on reader service card

IN VIDEO, TWO PORTS ARE BETTER THAN ONE

NEC'S NEW DUAL-PORT VIDEO DRAM TRIPLES CPU OUTPUT.

The Device: The world's first 256K dual-port video DRAM—uPD41264. An original, patented NEC design that runs rings around the competition in high-speed, high-density video applications.

The Principle: Two ports are better than one. You can process graphics data at higher speed by driving the 64K x 4 RAM port continuously. While video data exits asynchronously through the 256 x 4 serial port.

The Pay-Off: Dual porting lets you **use up to 95% of the RAM port bandwith.** *Versus 30% with standard DRAMs.* You can also reduce chip count, cut power consumption and streamline circuit design. It adds up to a quantum leap in system performance.

The Applications: Upgrade all raster scan systems with NEC's dual-port DRAM. Especially home and office computers, engineering work stations, remote terminals and CAD/CAM equipment.

The Source: NEC offers a fast-growing line of proprietary, application-specific devices. We specialize in original solutions to challenging problems in design. The result: innovative products that win industry-wide acceptance.

DRAM Selection Guide

	RAM PORT		**SERIAL PORT**	
DEVICE	Access Time	Cycle Time	Access Time	Cycle Time
41264C-12	120 ns	220 ns	30 ns	40 ns
41264C-15	150 ns	270 ns	40 ns	60 ns

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NEC

Circle 71 on reader service card

ECL RAMs COULD BE FIRST 4-BY-4 DESIGN

The MBM100484 and MBM10484 are claimed to be the first ECL RAMs organized as 4-K by 4 bits. They come housed in a Jedec standard package and are compatible with industry-standard 100K and 10K ECL parts, respectively.

Open-emitter outputs make memory expansion easy. Access time is only 15 ns, maximum, but power dissipation is a low 1.25 W, maximum, for the 100K part, 1.08 W, maximum, for the 10K part.

Both parts sell for $50 each in quantities of 1,000.

Fujitsu Microelectronics Inc., Marketing Communications, 3320 Scott Blvd., Santa Clara, Calif. 95054.
Phone (408) 727-1700 [Circle 371]

256-K CMOS EPROM HAS 150-NS ACCESS

At 150 ns, the μPD27C256 256-K CMOS EPROM is said to offer the world's fastest access time—or about a 12% to 25% improvement on competing memory chips. The EPROM is for use with high-speed microprocessors that operate at 10 MHz to 12 MHz.

Organized as 32-K by 8 bits, the chip can store the entire operating system of a personal computer, the company claims. Production quantities of the chip, packaged in a 28-pin DIP will be available this month. In 100-piece orders, the part will sell for $20.65. Slower versions, with times of 200 ns and 250 ns, are also available.

NEC Electronics Inc., P. O. Box 7241, Mountain View, Calif. 94039.
Phone (415) 960-6000 [Circle 372]

CONVERTER WORKS IN 5 MICROSECONDS

The ZAD2736 series of low-distortion sampling analog-to-digital converters boasts a 5-μs conversion time and an 8-μs total throughput time. The 16-bit converter has zero-crossover linearity and a midrange differential linearity of just 0.25 least significant bits.

The series is based on the company's proprietary three-pass, digitally corrected subranging technique and the company's monobit ADC architecture. The ZAD2736, which is packaged in a metal case measuring 3 by 4 by 0.44 in., comes either with or without built-in sample-and-hold circuitry.

In lots of 25 pieces, the sample-and-hold version sells for $479 each. In like quantities, the part without sample and hold goes for $459. Delivery takes 30 days.

Analog Solutions, 940 Detroit Ave., Concord, Calif. 94518.
Phone (415) 686-6660 [Circle 380]

SINGLE CHIP DOES TRIGONOMETRY

Trigonometric functions such as sine, cosine, tangent, secant, cosecant, and their inverses are performed on the AD639, the first single-chip trigonometric function generator. The AD639 eliminates complicated diode shaping networks and low-bandwidth methods using ROM look-up tables and digital-to-analog converters to generate precision functions, the company says.

The new part's can accurately compute trigonometric functions in real time. Users can thus perform precision triangle-wave-to-sinewave conversion, phase-angle calculations, and sine or cosine multiplication.

The AD639 accepts an input voltage representing an angle and generates an output voltage equal to the trigonometric function selected by the user. To generate the different functions, the user simply connects the appropriate pins. No external components or trimming are required.

Prices start at $1.95 each in lots of 100 pieces, with delivery from stock.

Analog Devices Inc., Literature Center, 70 Shawmut Rd., Canton, Mass. 02021
[Circle 381]

ACCELERATOR CUTS RULE-CHECKING TIME

The layout verification of IC designs has been speeded up, thanks to an accelerator subsystem that works with the manufacturer's Fast-Mask Engine. According to the company, design-rule checks on a custom 40,000-transistor IC took 9 h on the engine itself and only 70 min with the accelerator subsystem.

One of the first computers based on the 68020 microprocessor, the subsystem uses a parallel-processing architecture. The engine's speed results from new algorithms tailored to the subsystem's architecture. Its multiple 68020 processor boards let the subsystem perform several steps in a design-verification program simultaneously.

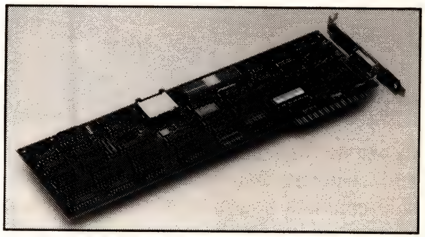
The subsystem, which will be available in September, adds $45,000 to the Fast-Mask Engine's basic price of $60,000.

Calma Co., 501 Sycamore Dr., Milpitas, Calif. 95035.
Phone (408) 434-4000 [Circle 379]

CARD LETS IBM PCs, UNIX MICROS TALK

A front-end-processor board, Exos 205, plus software connects IBM Corp. Personal Computers and compatibles with Unix computers such as Digital Equipment Corp. PDPs and VAXs.

The Exos 205 is based on the 80186 8-MHz chip, compatible with Ethernet and the IEEE-802.3 standard. Its 128-K bytes of dual-ported RAM let it receive messages while the PC's CPU handles the bus for other tasks. Value-added resellers can build networks that include a file server by exploiting the Exos 205's EPROM socket for a boot program, with 16-K bytes of address space.



The boards are priced at $995 each and are available now; the software, due in September, will consist of two packages priced at $350 each: Exos 8050 for PC-DOS and Exos 8011 for ATxenix.

Excelan Inc., 2180 Fortune Dr., San Jose, Calif. 95131.
Phone (408) 945-9526 [Circle 392]

FLEXIBLE LAN RUNS AT 1 MEGABYTE/s

The Cybertrans 3 is a turnkey local-area network that links IBM Corp. Personal Computers, PC ATs, and PC/XTs over 7,000 ft. Requiring no special electronics expertise to install, the net is flexible enough to include PCs that have no disk drives. Communication among machines is established by PCnet, which does not require a separate file server and needs only standard TV-type coaxial cable for installation. The net's data-transmission rate is 1 megabyte/s.

The net's concurrent operation allows communication to take place in the background while other tasks continue uninterrupted on the PCs. Prices and delivery information were unavailable.

Cyber Research Inc., P. O. Box 9565, New Haven, Conn. 06536.
Phone (203) 786-5151 [Circle 390]

BOOKS

HANDBOOK OF ELECTRONICS INDUSTRY COST ESTIMATING DATA

Theodore Taylor Jr.
John Wiley & Sons Inc./Interscience
$54.95/416pp

A new editor has revised and in many places rewritten the *Handbook*, which was originally published in 1964, to reflect 20 years of change in the technology of electronics. He has added five new chapters covering plastics, fiber optics, automatic testing, ICs, and computer-aided design and manufacturing.

The standard data in this handbook is based on predetermined time standards, time studies, and rough synthesis by methods analysis; though the book is oriented primarily toward shops producing military-type systems in small volumes (quantities from 1 to 1,000), the data is equally applicable to cost estimating any electronics product. A one-page summary table, developed for each cost area, minimizes detailed timetables, and a sample set of cost-estimate forms is provided. The author's dollars-and-sense approach shows a manager how to assess an ongoing operation's productivity, while the capsule descriptions of each step in developing a product can help a novice gain expertise.

SOLID MODELING APPLICATIONS, THE REAL PAYBACK

Computer-Aided Manufacturing International Inc.
$250/534pp

The third Geometric Modeling Seminar held earlier this year set benchmarks for commercial solid-modeling systems in computer-based analysis, part control, and manufacturing applications. It also created a forum for a discussion of user requirements in these applications.

Companies participating were Computervision, Dassault Systems, MAGI, Matra Datavision, SDRC, and Shape Data. Copies of the seminar's proceedings are available from CAM-I, Conference Services, 611 Ryan Plaza Dr., Suite 1107, Arlington, Texas 76011.

1985 ELECTRONIC MARKET DATA BOOK

Electronic Industries Association
$80/166pp

This standard reference covers production, sales, foreign trade, research and development, and U.S. government markets. The information, which comes from several hundred companies, is supplemented by government and private sources. The contents are divided into consumer electronics, communications equipment and systems, computers and industrial electronics, government electronics, and electronic components.

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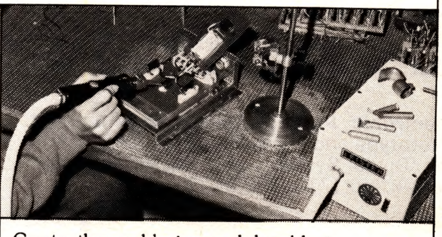

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Circle 59 on reader service card

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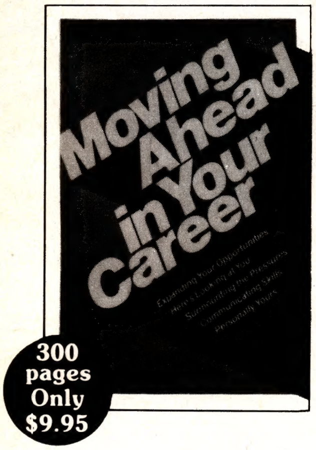
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Research Staff, Ford Motor Company, has established a new cleanroom facility to develop advanced IC devices for product and manufacturing applications. All equipment for the design and fabrication of prototype bipolar and CMOS devices are in place. This includes a Metheus CAD station with VAX support of simulation and design rule software. Two key positions on this staff are available:

Facility Manager — Responsibilities include development of bipolar and CMOS processes. An important requirement is process development and characterization in conjunction with the design group and advanced project user groups. A process group and a facilities operator report to the Section Head.

This position requires a PhD Degree (or equivalent experience) in Electrical Engineering, Physics, Chemistry, or Materials Science, and six years experience in silicon wafer processing. Applicants must have familiarity with all details of planar processing in bipolar and CMOS technologies.

Designer — Responsibilities include carrying a circuit concept through design to layout in conjunction with the in-house process group.

This position requires an MS Degree in Electrical Engineering or Physics with five years experience in bipolar design, preferably in linear circuit design, and a willingness to learn CMOS design.

Ford Motor Company offers an excellent fringe benefits program and competitive salary. Applicants must possess a citizenship or visa status which permits them legally to accept permanent employment under U.S. Immigration laws. If one of these opportunities matches your qualifications and interests, for prompt consideration, please forward your resume and salary requirements to:

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Systems Engineer — 40 hours per week; 9:00 AM - 5:00 PM, $33,000.00 yearly. Provide technical advise to sales personnel in regard to the installation, use and maintenance of Fujitsu 8500 Small Business Computers, point of sales terminal stations and other microcomputers. Help to develop programs using COBOL and C language to suit customers' needs. Required to troubleshoot after systems are installed. Will be on call to service systems installed in the States of Indiana, Illinois, Wisconsin, Minnesota, Kentucky, Missouri and Tennessee. 8 years grade school, 4 years high school and 6 years college (Master of Computer Science) required. 2 years experience as systems engineer also required. Must have 1 year experience as engineer with Fujitsu Model 8500 Business Computers, point of sale terminal stations and micro-computers. Applicant must have one year experience using COBOL and C language computer languages. Send resume to Illinois Job Service, 910 South Michigan Avenue, 3rd Floor, Chicago, IL 60605. Attn: Joan Sykstus. Ref. #4683-T. An employer paid ad. Equal Opportunity Employer.

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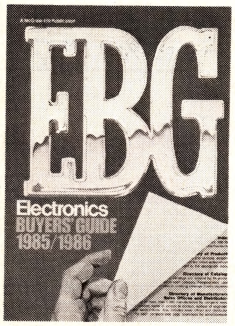

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```
#2,(A1)
#0,(A0)
#3,(A1)
#4,(A0)
#0,(A1)
#3,(A0)          ;INITIALIZE AND GO


#15,P15          ;POINT TO SEG 0
#14,P15


                 ;POINT TO TMD1
#$8022,A3
#15,(A3)         ;WAIT FOR OWNERSHIP.
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